

United States Patent [19]

Townsend et al.

[11] Patent Number: 4,798,175

[45] Date of Patent: Jan. 17, 1989

[54] ELECTRONIC IDENTIFICATION SYSTEM

[75] Inventors: Ted H. Townsend, Kansas City; Clinton L. Moore, Parkville; John T. Machnicki, Kansas City, all of Mo.

[73] Assignee: Alfa-Laval Agri, Inc., Kansas City, Mo.

[21] Appl. No.: 917,034

[22] Filed: Oct. 9, 1986

[51] Int. Cl.⁴ A01K 5/02; G08B 13/24

[52] U.S. Cl. 119/155; 119/51 R; 340/572; 340/573

[58] Field of Search 119/51 R, 155, 159; 340/572, 573

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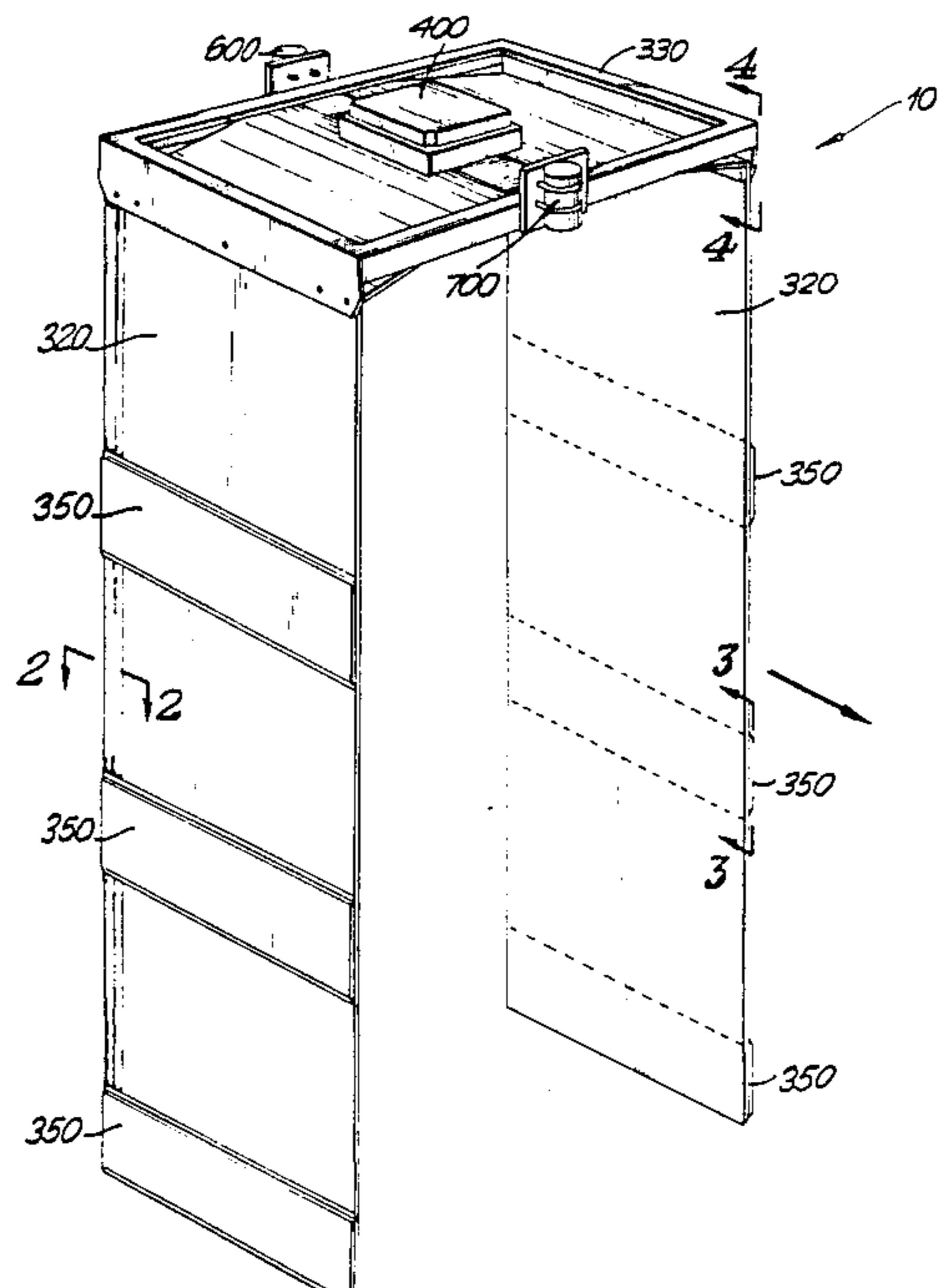
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Primary Examiner—Robert P. Swiatek
Attorney, Agent, or Firm—Davie Hoxie Faithfull & Hapgood

[57] ABSTRACT

An electronic identification system for identifying an animal moving through a portal structure is disclosed. A transponder worn on a rope or chain around the neck of the animal is energized by a multi-directional electromagnetic field generated by a double antenna loop in the portal structure. The transponder, when energized, will transmit identifying data back to the antenna loop after the electromagnetic field has been removed. That information will be processed by a microprocessor so that the animal can be identified. The antenna loop is secured within a flexible free-hanging curtain. The curtain is attached only at the top to the frame of the portal structure; the bottom of the curtain is free-hanging so that the curtain and antenna loop will not be damaged if the animal kicks the curtain. The system also includes two ultra-sonic transducers positioned at the entrance and exit of the portal. These two transducers are used to separately detect the presence of the animal in the portal structure and also to determine the direction of movement of the animal.

10 Claims, 7 Drawing Sheets



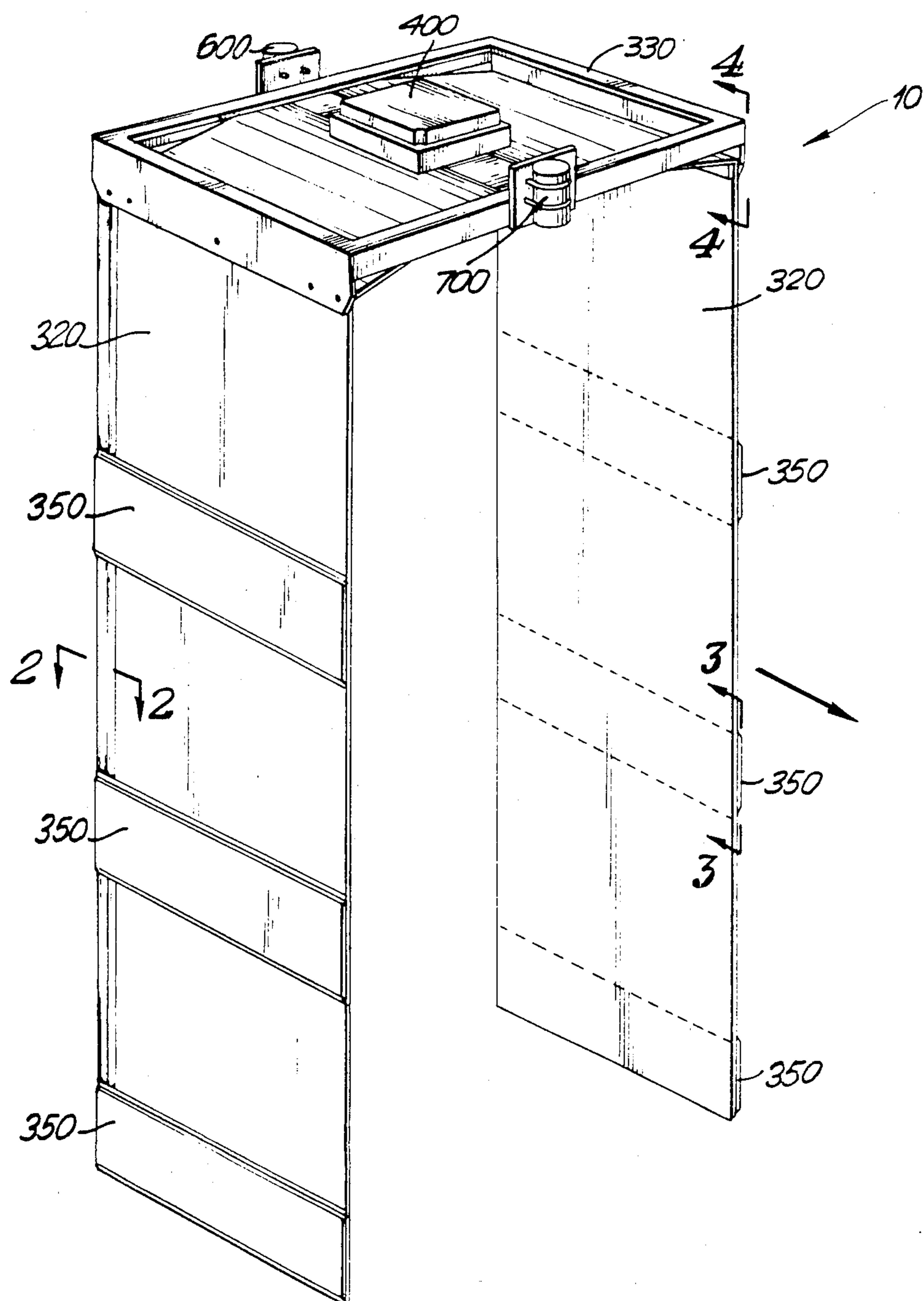


FIG. I

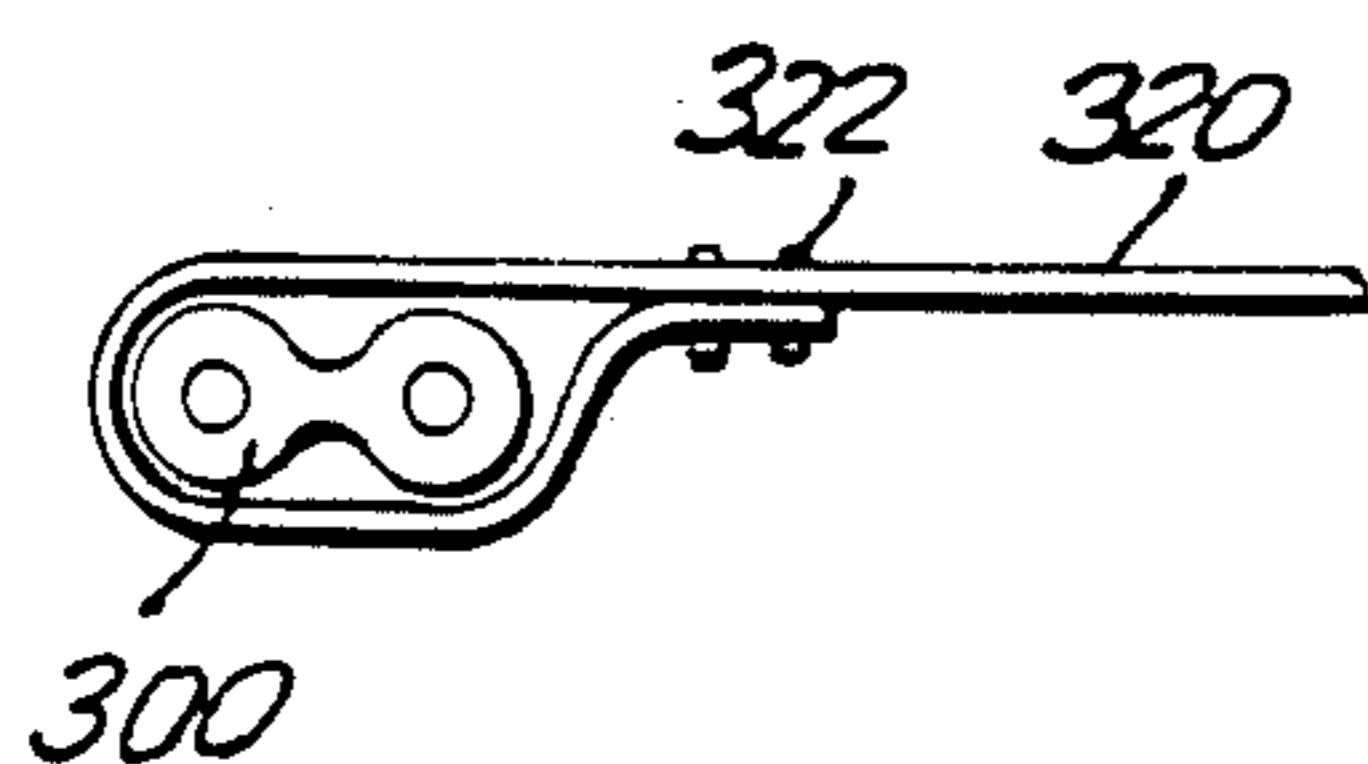


FIG. 2

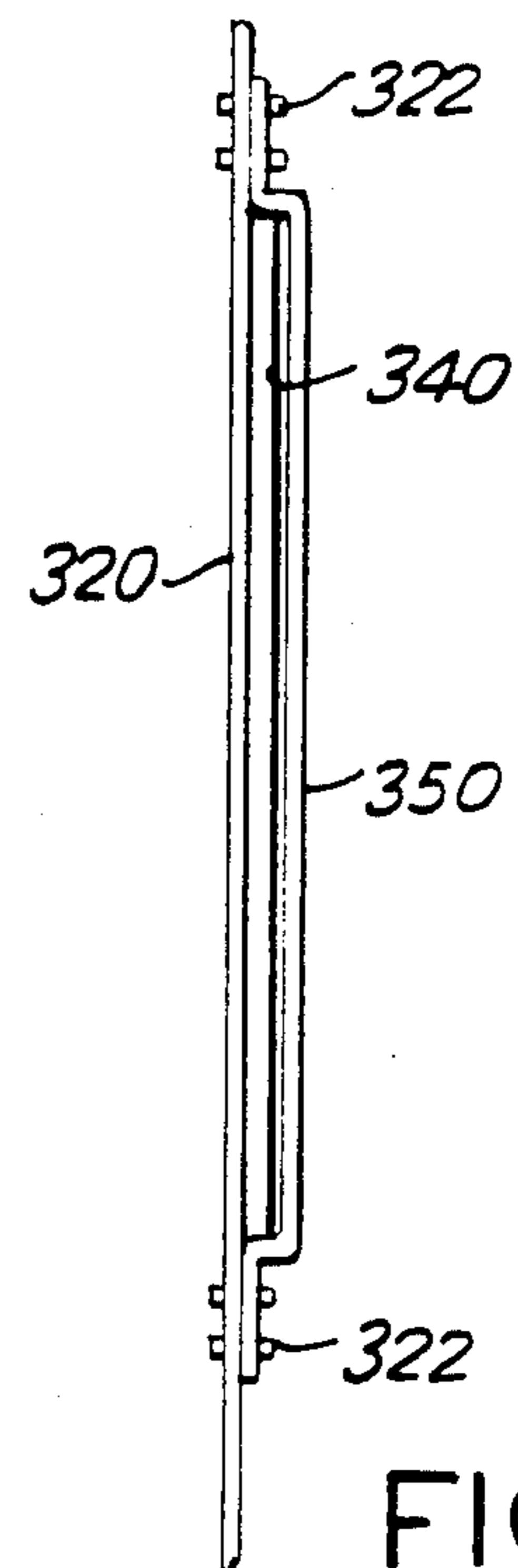


FIG. 3

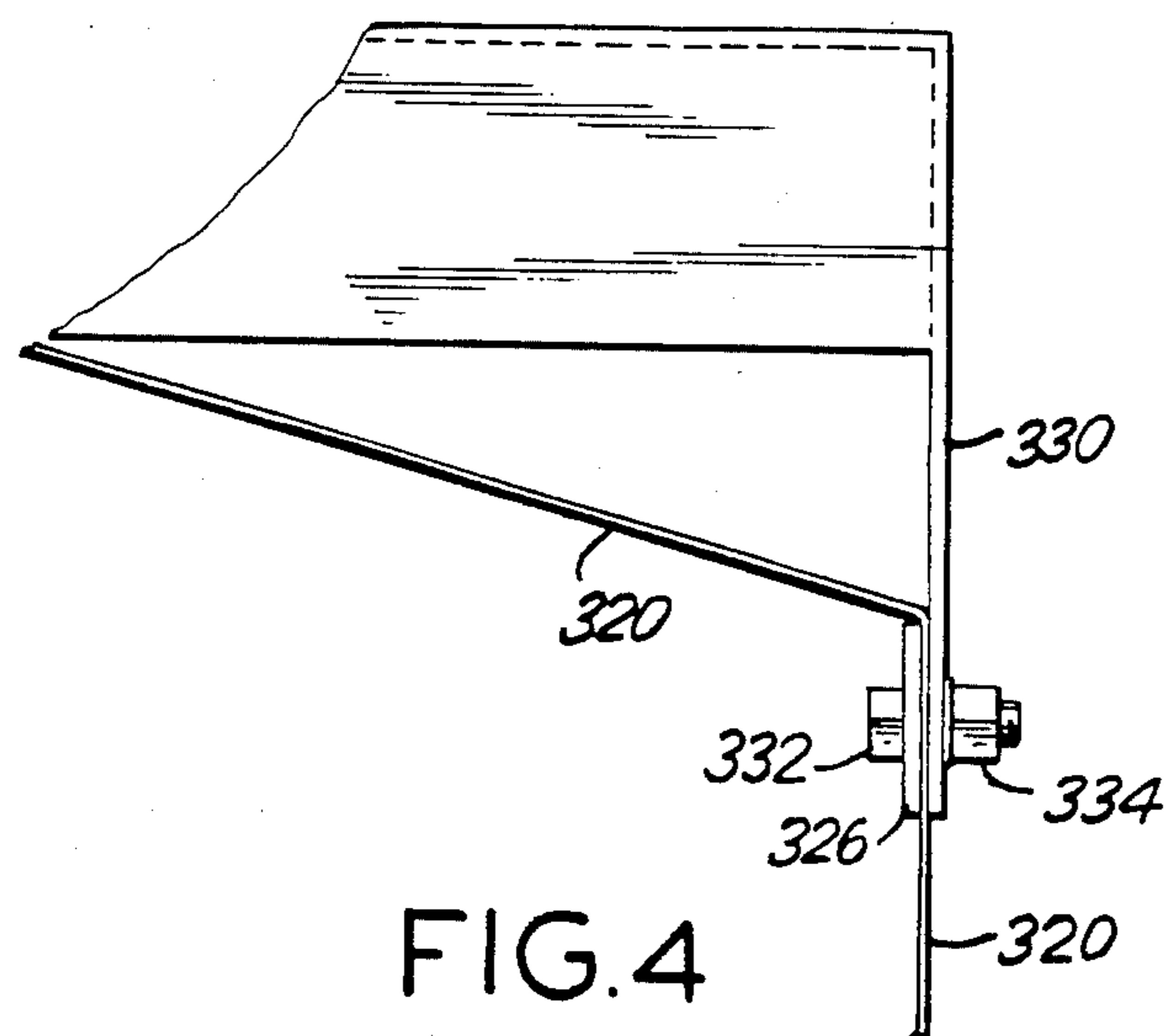


FIG. 4

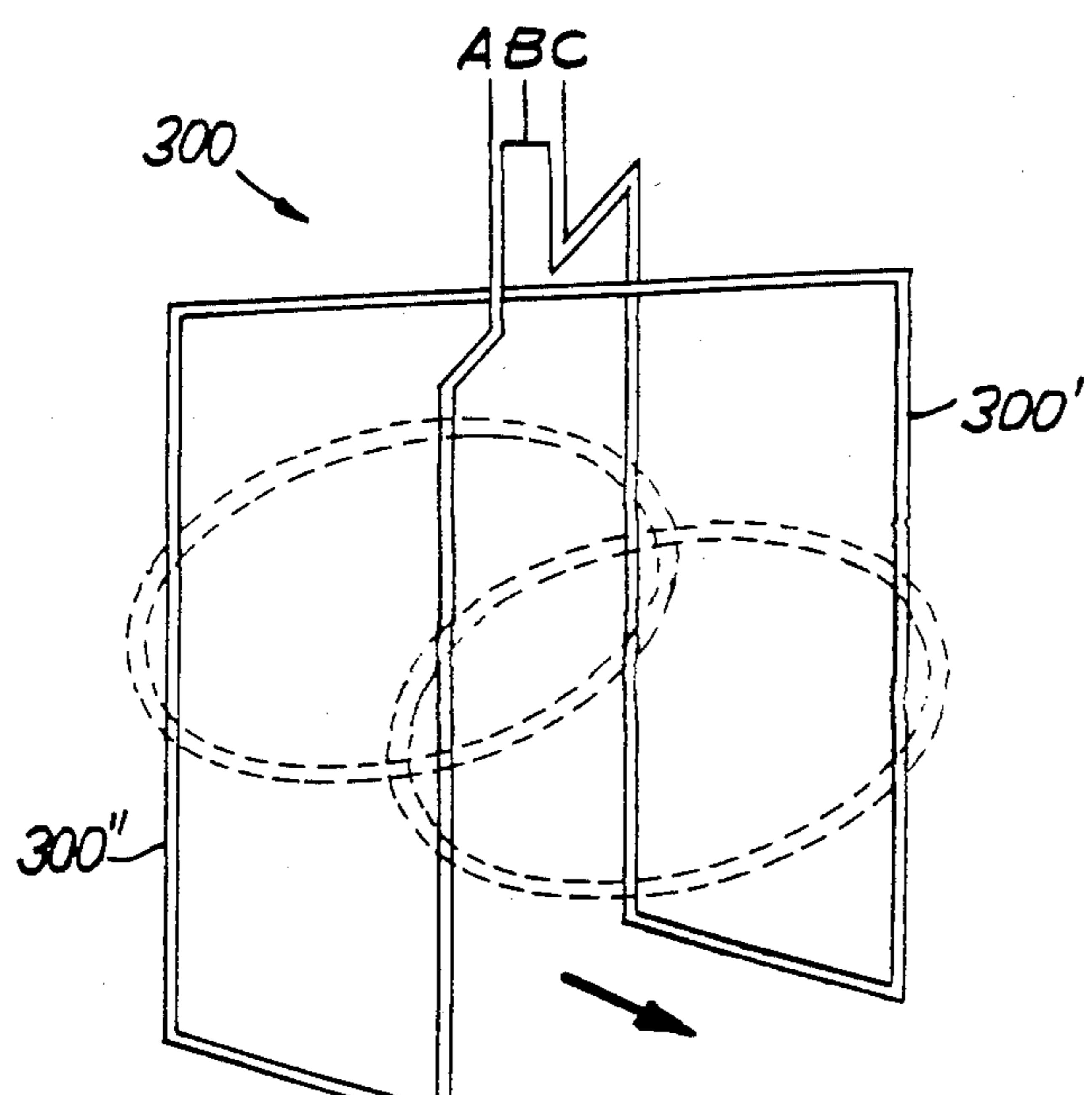


FIG. 5

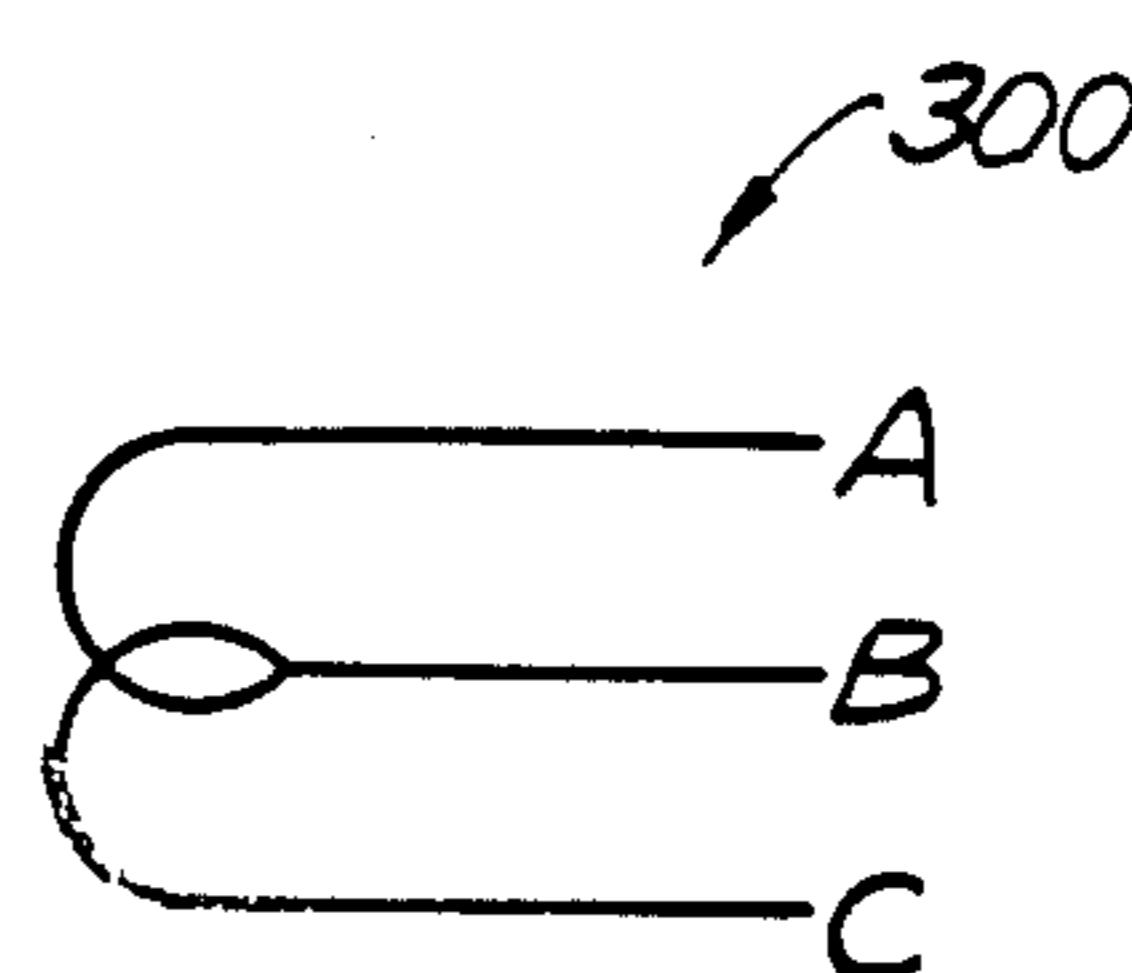


FIG. 5A

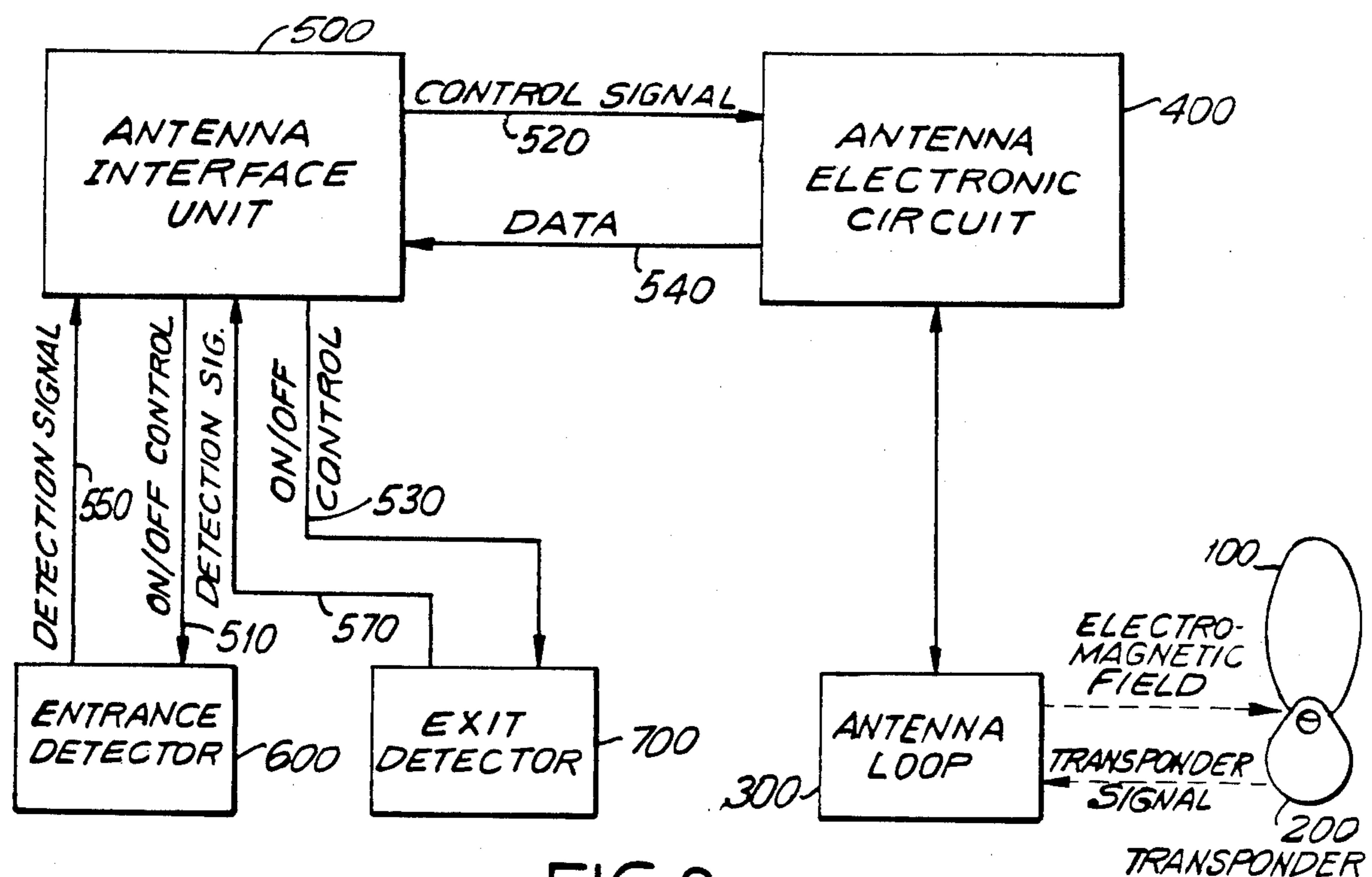


FIG.6

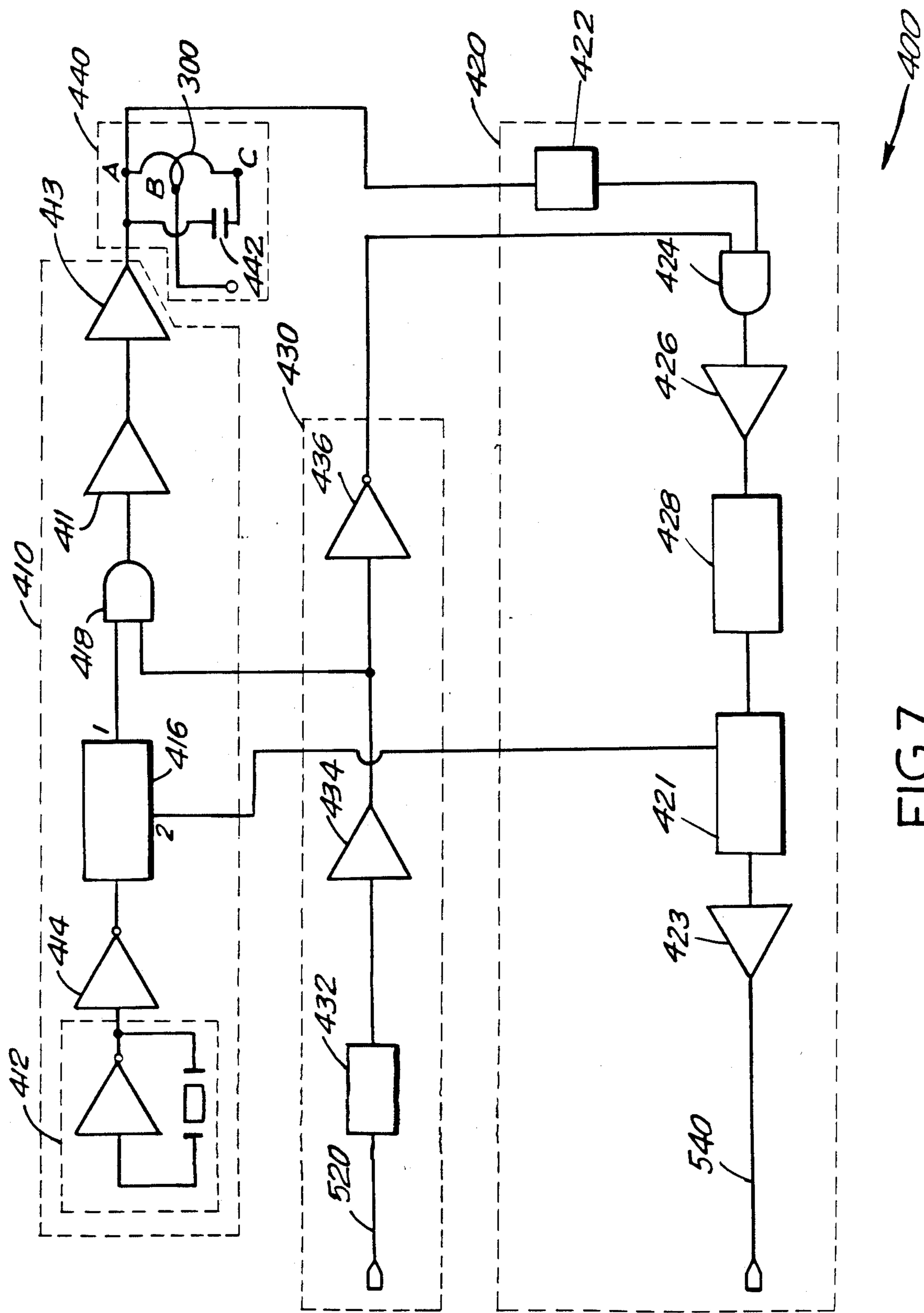
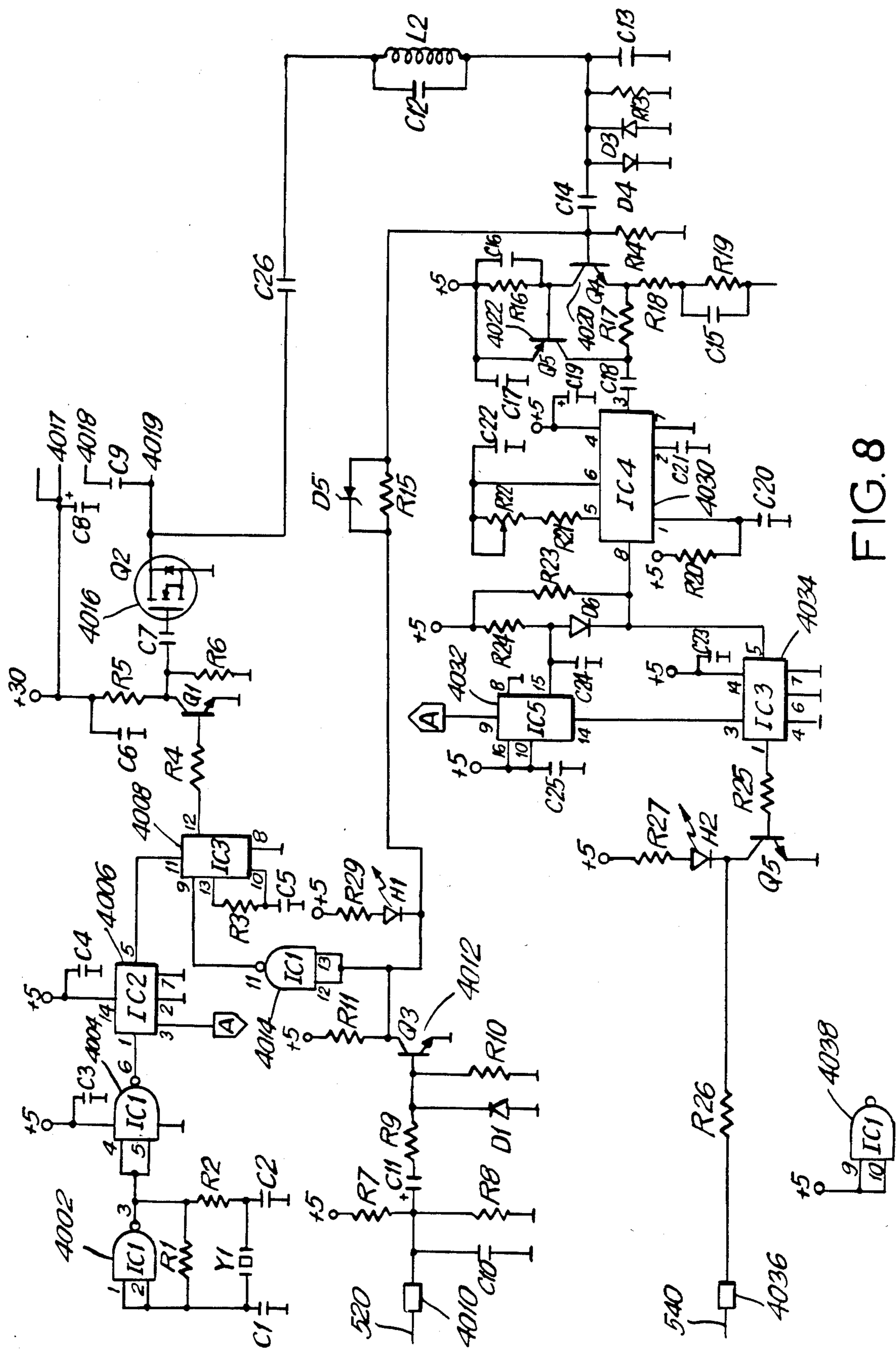


FIG. 7



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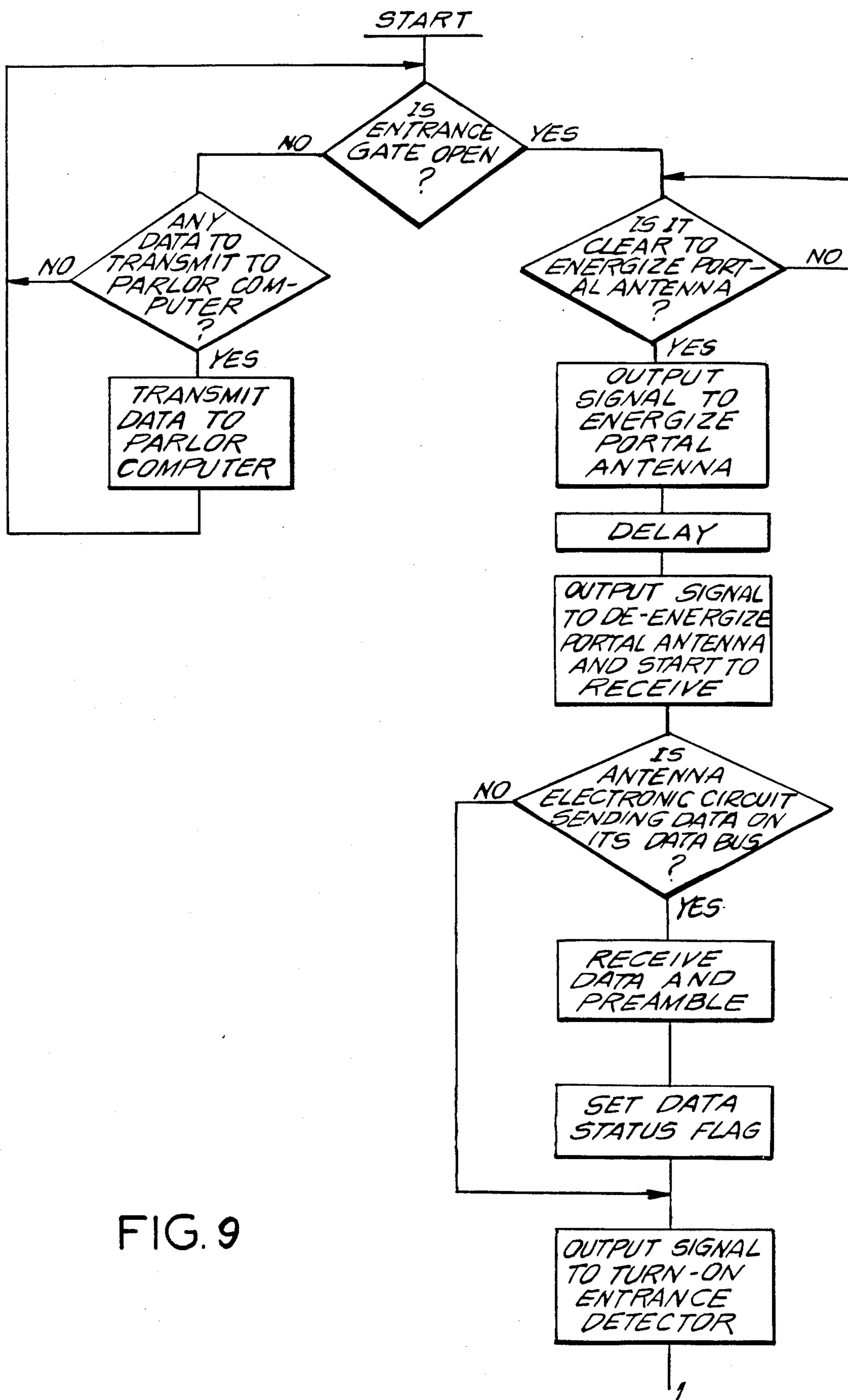
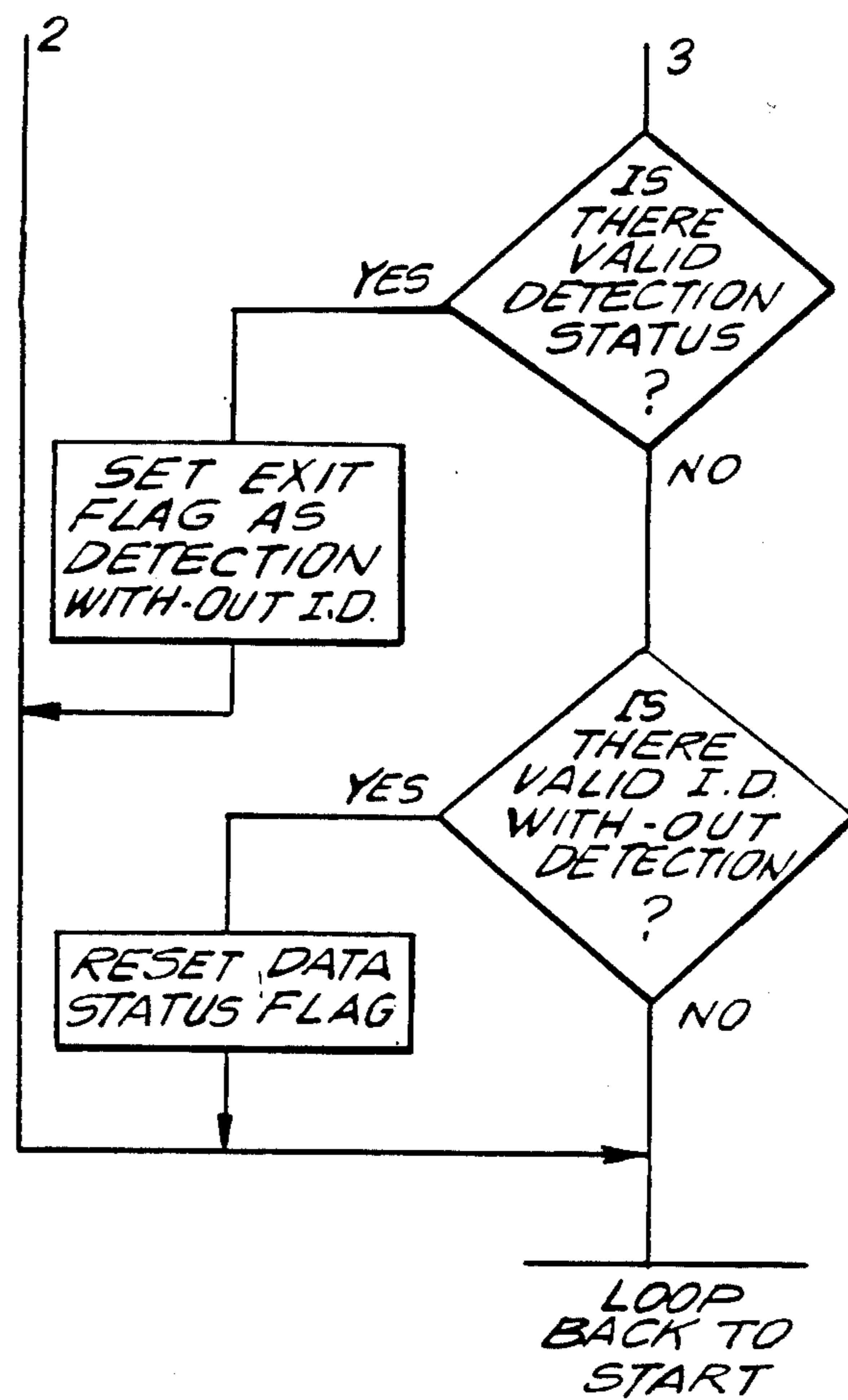
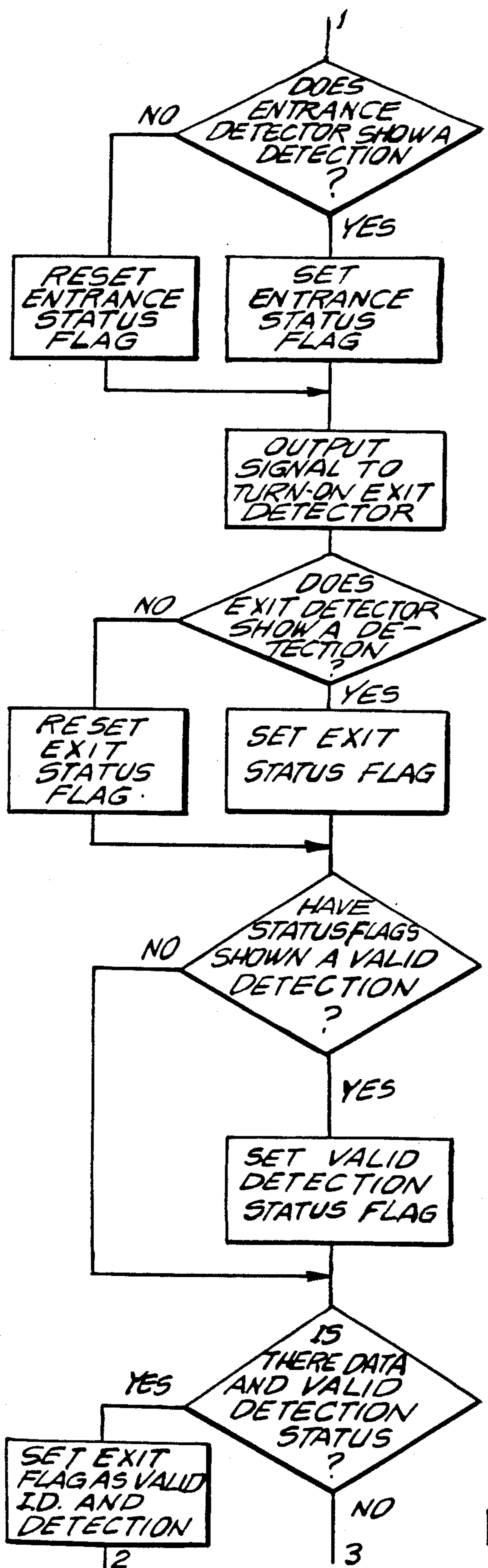


FIG. 9



ELECTRONIC IDENTIFICATION SYSTEM**FIELD OF THE INVENTION**

This invention relates to an improved electronic identification system for identifying a moving object where the object is moving through a portal structure or the like.

BACKGROUND OF THE INVENTION

Accurate electronic identification of objects moving through an area is highly desirable. Electronic identification systems eliminate the need for visual monitoring of the objects by a person. Therefore, a greater volume of moving objects may move through the area of interest and still be detected. Further, because electronic identification systems can be adjusted to respond quickly to moving objects, the speed of movement of the moving objects may be increased without the electronic identification system losing the ability to identify the objects.

In the dairy industry such an electronic system is particularly useful. On a dairy farm a limited number of persons operate a milking parlor and many cows enter the parlor for milking in a short time. It is critical to know which cow is approaching the milking apparatus for milking, as the dairy farmer needs to be able to monitor, and also record, the daily milk output for each cow. Without a fast and accurate electronic identification system, the milking parlor operator would have to visually identify each cow, thus causing extensive time delays in the milking procedure.

Prior attempts to electronically identify farm animals include U.S. Pat. to Carroll No. 4,475,481, issued Oct. 9, 1984, where a passive transponder device containing a coil is hung on a chain or rope around the animal's neck. For identifying an animal which is feeding, the '481 patent apparatus provides an identifier in the feeder box. The identifier has a coil driven by a power amplifier for transmitting energy to the coil in the transponder. The energized transponder then generates an RF signal containing unique identifying information relating to that animal. This signal containing identifying information is transmitted back to the identifier where it is decoded and sent to a computer, which then directs an auger in the feeder box to dispense the proper amount of feed for that particular animal.

A significant problem with the '481 patent apparatus is that the electromagnetic field generated by the identifier, which is used to energize the transponder, is oriented in only one direction, and therefore, if the animal turns his or her head 90°, the axis of the coil in the transponder becomes perpendicular to the axis of the coil in the identifier, and there is insufficient magnetic coupling between the identifier and the transponder, resulting in a failure to energize the transponder and a consequent inability to identify the animal based on transponder-transmitted information.

The Carroll '481 apparatus also does not provide any separate means for sensing the presence of the animal in the feeder (apart from the transponder signal) or for sensing the direction of movement of the animal. Such information is of value as a check on the accuracy of any detection based on the presence of a transponder signal and allows for greater control and monitoring ability of a procedure involving a large number of mov-

ing objects, such as cows moving through a milking parlor.

SUMMARY OF THE INVENTION

The present invention is for an improved electronic identification system for identifying objects, particularly farm animals, moving through a portal structure. A double loop antenna generates a multi-directional electromagnetic field which is used to energize a transponder worn by the animal. When energized by the electromagnetic field, the transponder will transmit identifying data back to the antenna loop. A circuit decodes the identifying data and in conjunction with a microprocessor determines if the data is valid. Because

of the configuration of the antenna loop, sufficient energy is radiated to the transponder and the transponder signal is received even if the axis of the transponder is changed due to a head movement of the animal or due to the animal entering the portal structure at an angle.

The antenna loop is secured within a flexible free-hanging curtain. The curtain is attached to a frame of the portal structure only at the top. Therefore, the bottom of the curtain is free-hanging and the curtain and antenna loop will not be damaged by a kick from the animal. Stiffener plates in pocket flaps of the curtain may be used to strengthen the curtain.

Two ultra-sonic detectors, one at the entrance to the portal structure and one at the exit to the portal structure, are used to separately detect the presence of an object in the portal structure. A microprocessor, by monitoring the two detectors or sequence, can also determine the direction of movement of the object through the portal structure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing an embodiment of the electronic identification system of the present invention using a portal structure;

FIG. 2 is a top view of a portion of the antenna curtain of the portal structure along lines 2-2 of FIG. 1;

FIG. 3 is a front elevational view of a portion of the antenna curtain of the portal structure along lines 3-3 of FIG. 1;

FIG. 4 is a front elevational view of a portion of the frame of the portal structure along lines 4-4 of FIG. 1;

FIG. 5 is a perspective view of the antenna loop within the antenna curtain of the portal structure of FIG. 1 showing as dotted lines the electromagnetic field generated by the antenna loop;

FIG. 5A is a schematic representation of the antenna loop of FIG. 5;

FIG. 6 is a block diagram of the identification system of the present invention;

FIG. 7 is a block diagram of the antenna electronic circuit of FIG. 6;

FIG. 8 is an electrical schematic drawing of a portion of the antenna electronic circuit of FIG. 7; and

FIGS. 9-11 are flow charts of software programs which may be used by the antenna interface unit shown in FIG. 6.

DETAILED DESCRIPTION OF THE INVENTION

The electronic identification system of the present invention is described below, for exemplary purposes only, in terms of an embodiment for animal identification. It is readily apparent that the present invention may be used for any number of different identification

tasks, including identification of objects carried or worn by a person, wherein the object to be identified is moving through an area such as a portal structure.

Referring now by reference characters to the figures which illustrate an embodiment of the present invention, an animal such as a cow (not shown), wearing a chain, rope or strap 100 (FIG. 6) containing a transponder 200, moves through a portal structure 10 (FIG. 1) in the direction of the arrow.

As the animal passes through the portal structure 10, the transponder 200 receives energy at one frequency from an electromagnetic field (shown as dotted lines in FIG. 5) generated by an antenna loop 300 contained within a curtain 320 in the portal structure 10. After the circuitry in the transponder 200 is charged to a predetermined value, the electromagnetic field is removed, and the transponder 200 transmits identifying information concerning the animal, at a second frequency, back to the antenna loop 300. This information is processed by an antenna electronic circuit (AEC) 400 (FIGS. 6, 7) and an antenna interface unit (AIU) 500 (FIG. 6). In an application of the present invention to a milking parlor, the AEC 400 and the AIU 500 are used to verify that the identifying information is valid and further assign the milk output to a particular cow.

Another feature of the identification system of the present invention is the detection of the presence and the direction of movement of the animal moving through the portal structure 10 using an ultra-sonic entrance detector 600 and an ultra-sonic exit detector 700, which are both monitored by the AIU 500 as described in further detail below.

FIG. 6 shows in block diagram form the components of the identification system of the FIG. 1 embodiment, including the transponder 200, the antenna loop 300, the AEC 400, the AIU 500, the entrance detector 600 and the exit detector 700.

The electromagnetic field (shown as dotted lines in FIG. 5) develops a voltage in a parallel resonant circuit (not shown) of the transponder 200. This resonant circuit, in the present embodiment, is tuned to the frequency of the transmitted voltage from the antenna loop 300, e.g. a frequency of 131,072 Hz. Thus, the transponder 200 is charged in a conventional manner. As long as the electromagnetic field from the antenna loop 300 is present, the transponder cannot act as a transmitter. However, when the electromagnetic field is removed, the parallel resonant circuit of the transponder radiates a different frequency, e.g. a 98,304 Hz signal, to the antenna loop 300, which acts as a receiver when the electromagnetic field is removed.

The radiated signal from the transponder 200 is a signal consisting of three parts. The first part is a preamble used to show the start of a transmitted message from the transponder 200. The second part is a fixed delay period so that the AEC 400 and the AIU 500 have sufficient time to decode the preamble and determine whether a valid transponder signal (i.e., a signal corresponding to a known transponder) is being transmitted. Parts 1 and 2 of the transponder output signal are the same for all transponders.

The third part of the transponder signal is the unique identifying data for the particular animal. This identifying information in the present invention consists of 14 data bits and a parity bit. This third part of the signal is unique for each transponder and is set by changing the program pins on an encoding chip (not shown) in the transponder 200. Such encoding chips and the remain-

ing circuitry in the transponder 200 are well-known in the art. The data from the transponder 200 is transmitted to the antenna loop 300 in the following order: preamble, delay period and identifying information.

After the transponder 200 has transmitted all three parts of the output signal, the transponder will cease to transmit any signals. Further energization of the transponder 200 by the antenna loop 300 will result in a repeat transmission by the transponder 200 of the three-part transponder signal.

Thus, as described above, the electromagnetic field generated by the antenna loop 300 energizes the transponder 200 with a signal at one frequency (e.g., 131,072 Hz) when the animal enters the portal structure 10. When the electromagnetic field is removed, the energized transponder 200 transmits identifying information to the antenna loop 300 at a second frequency (e.g. 98,304 Hz).

In the identification system shown in U.S. Pat. No. 4,475,481, a problem develops if the animal (while wearing a transponder around the neck) turns his or her head when the head is in the feeder box. Because the electromagnetic field in the '481 patent generated by a coil in the identifier in the feeder box is oriented only in one direction, a turn in the animal's head causes the axis of the coil of the transponder to be nearly perpendicular to the axis of the coil in the identifier, resulting in insufficient electromagnetic coupling between the coil in the identifier and the pick-up coil in the transponder. Therefore, to achieve electromagnetic coupling sufficient to energize the transponder, the '481 patent apparatus requires a specified positioning of the transponder in relation to the identifier.

The present invention eliminates this problem because even if the animal turns his or her head when entering the portal structure 10, or enters the portal structure 10 at an angle, the multi-directional configuration of the electromagnetic field, as shown by the dotted lines in FIG. 5, permits maximum transfer of energy between the antenna loop 300 and the transponder 200 regardless of the angular orientation between the antenna loop 300 and the transponder 200. Because antenna loop 300 generates electromagnetic fields in four angular relations to the direction of animal travel through the portal structure 10 (-90°, -45°, 45° and 90°), the transponder 200 will pick up enough energy to be energized even if the animal turns his or her head or enters the portal structure 10 at an angle. Similarly, when the antenna loop 300 receives identifying information from the transponder 200, the multi-directional configuration of the antenna loop 300 insures that the antenna loop 300 receives enough of the transponder signal for identification purposes even if the animal turns his or her head.

Also, as seen in FIG. 5, the antenna loop 300, configured in a double loop arrangement, is present on both sides of the portal structure 10. Therefore, the transponder 200 will be subjected to electromagnetic radiation from a left-hand loop portion 300' of the antenna loop 300 and from a right-hand loop portion 300'' of the antenna loop 300 as the animal moves through the portal structure 10 in the direction of the arrow in FIG. 5. This results in the transponder 200 receiving sufficient energy even if the animal does not enter exactly through the middle of the portal structure 10.

The present invention, unlike the '481 patent apparatus, does not require the transponder 200 to be positioned in a certain fashion relative to the portal struc-

ture 10 to insure identification. Further, unlike the '481 patent apparatus, the present invention does not require the animal to be a specified distance from the antenna loop 300, so long as the animal passes through the portal structure 10.

FIG. 7 shows the block diagram form the antenna electronic circuit 400 (AEC). The AEC 400 has a transmission circuit section 410, a receiver circuit section 420, a control circuit section 430 and a parallel resonant circuit section 440.

Transmission circuit 410 powers the parallel resonant circuit 440 so that the parallel resonant circuit 440 generates an electromagnetic field and radiates energy to energize the transponder 200. When switched from the transmission mode to the receiving mode, the parallel resonant circuit 440 receives identifying information from the transponder 200, and the receiving circuit 420 decodes that information and outputs it to the AIU 500 along data bus 540. Control circuit 440, under the direction of a control signal from the AIU 500 along control bus 520, alternatively enables the transmission circuit 410 and the receiver circuit 420, depending on whether the AEC 400 should be transmitting energy to energize the transponder 200 or receiving identifying information from the transponder 200.

The transmission circuit 410 of the AEC 400 in the present embodiment operates as follows. The signal from a 4.194304 Mhz oscillator 412 is fed to a buffer 414. The buffered signal is divided down by frequency divider 416, with output 1 of the divider 416 at 131,072 Hz 30 and output 2 at 32,768 Hz. Output 2 of divider 416 is used in the receiver circuit 420 of the AEC 400, as described in more detail below.

The 131,072 Hz signal from output 1 of divider 416 is gated on and off in gate 418 by the control signal from driver 434. The output from gate 418 is applied to a pulse shaper and driver 411, whose output is applied to a power amplifier 413. The output pulses from amplifier 413 drive the resonant circuit 440 (consisting of the antenna loop 300 and capacitor 442) and cause the resonant circuit 440 to oscillate at a frequency of, e.g. 131,072 Hz.

The resonant circuit of the transponder 200 is tuned to this same frequency of 131,072 Hz. The electromagnetic field created by driving the resonant circuit 440 45 energizes the transponder 200 when the animal enters the portal structure 10 in the manner previously described.

As seen in FIGS. 5, 5A and 7, the antenna loop 300 is center-tapped in order to double the voltage in the 50 resonant circuit 440, with point A of the antenna loop 300 connected to the output of amplifier 413 and capacitor 442, point C connected to capacitor 442 and point B, the center-tap, connected to the supply voltage.

When the control circuit 430, under the direction of a control signal from the AIU 500 along control bus 520, turns off the transmission circuit 410, the receiver circuit 420 is turned on. The receiver circuit 420 operates in the following manner. The transmitted identification signal from the transponder 200 is received by the resonant circuit 440. That transponder signal passes through limiter 422 which excludes frequencies not of interest. The output signal from limiter 422 is gated on and off in gate 424 by a control signal from driver 436. The output from gate 424 is then amplified by amplifier 426 and 60 decoded by the decoder 428 which has an internal frequency equal to the transmission frequency of the transponder signal, e.g. 98,304 Hz. The tone decoder 428

converts the RF data burst signal to a digital level signal. If the input signal to the tone decoder 428 is not 98,304 Hz, indicating that the received signal is not a valid transponder signal, then no output signal is applied to a Manchester encoder 421. However, if the frequencies are the same, then the tone decoded signal is coupled to the Manchester encoder 421. As seen in FIG. 8, output 2 from frequency divider 416 inputs into the Manchester encoder 421. The encoder 421 is used to 10 create a data transmission signal (consisting of a preamble, time delay period and identifying information from the transponder) that can be transmitted to the AIU 500 through a driver 423 along data bus 540. The AIU 500 can detect an error in this signal.

Control circuit 430 operates to control the transmission circuit 410 and the receiving circuit 420 in the following manner. When the AIU 500 wishes to instruct the AEC 400 to transmit energy to the transponder 200, an appropriate signal on control bus 520 passes through protection circuit 432 and driver 434 to gate 412, ultimately resulting in the driving of the resonant circuit 440 in the manner previously described. While the transmission circuit 410 is on, the receiver circuit 420 is off because driver 436 inverts the signal from driver 434, and gate 424 will not pass the transponder-transmitted signal to the tone decoder 428.

An appropriate change in the signal on control bus 520 from AIU 500 disables the transmission circuit 410 and enables the receiver circuit 420.

FIG. 8, which shows the components for a specific embodiment of FIG. 7, has an oscillator 4002 and associated circuitry, followed by a buffer 4004 and a frequency divider 4006. Output 5 of divider 4006 emits a signal with a frequency of 131,072 Hz to one-shot pulse generator 4008. Output 3 of divider 4006, a 32,768 Hz signal, is used in the receiving portion of the AEC 400, as described below.

Generator 4008 will output an inverted output pulse provided that the control signal applied by the AIU 500 along control bus 520 to terminal 4010 is "high," resulting in the turning on of transistor 4012 and the inverting of the output from the collector of transistor 4012 by inverter 4014. This "high" control signal at terminal 4010 turns on the transmission circuit 410 of the AEC 400.

The output pulse from the generator 4008 is applied to the gate of MOSFET 4016. As the MOSFET 4016 is pulsed on and off, the resonant circuit consisting of capacitor C9 and the center-tapped antenna loop (connected to terminals 4017, 4018 and 4019) oscillates at a frequency of 131,072 Hz.

As long as the transistor 4012 is on in response to an applied "high" control signal at terminal 4010, the bias at transistor 4020 is removed and the receiver circuit of the AEC 400 is turned off.

The maximum time transistor 4012 can be turned on is limited by the time constant of capacitor C11 and resistors R7 and R8. This time constant is for a longer duration than the control signal at terminal 4010 to insure that the control signal will control the operation of the transistor 4012.

When the "high" control signal is removed from terminal 4010, the transmission circuit of the AEC 400 turns off and the receiving circuit is turned on. The receiving circuit is turned on by virtue of the fact that when transistor 4012 is turned off, the bias voltage is reapplied to transistor 4020.

When in the receiving mode, the antenna loop connected at terminals 4017, 4018 and 4019 receives the transmitted transponder signal. That transponder signal is coupled through capacitor C26 to the resonant circuit consisting of inductor L2 and capacitor C12, which blocks any energy from the transmitter of the AEC 400 (when it is on) from reaching the receiver portion of the AEC 400.

The received signal then passes through some limiting components and is applied to the amplifier circuit consisting of transistors 4020 and 4022 and related circuitry. The amplified signal is applied to the tone decoder 4030, which operates in the manner described above for the decoder 428 of FIG. 7. Resistor R22 adjusts the internal frequency of decoder 4030 to a frequency of 98,304 Hz.

The Manchester encoder 421 of FIG. 7 is shown as integrated circuits 4032 and 4034 with related circuitry. Integrated circuit 4032 also receives as an input the 32,768 Hz signal from output 3 of divider 4006. The output data from this Manchester encoder scheme is outputted to the AIU 500 on data bus 540 at terminal 4036.

Oscillator 4002, buffer 4004, inverter 4014 and circuit 4038, in the present embodiment, are all part of one integrated circuit. Similarly, one-shot pulse generator 4008 and circuit 4034 are also part of a single integrated circuit.

Chart I below provides an identification of the components in FIG. 8.

-continued

CHART I

Symbol	Value	Description
IC3	MC14013	Integrated circuit
IC4	LM567CN	Integrated circuit
IC5	MC14520	Integrated circuit
L2	680 μ H	Inductor
H1		Green L.E.D.
H2		Yellow L.E.D.
Y1	4.194304 MHZ	Crystal

FIGS. 1-4 show in detail the portal structure 10, and reference should be made to those figures in conjunction with the following description.

When used to monitor dairy cattle, the width of the portal structure 10 should be approximately 28", the height approximately 69" and the depth approximately 17". These dimensions permit cows of various sizes to easily walk through the portal structure 10. The size of the portal structure 10 may be adjusted to accommodate animals or persons as required, and also may be configured to conform to the size requirements of the area surrounding the portal structure 10.

The antenna loop 300, having a left-hand portion 300' and a right-hand portion 300" (FIG. 5) is contained within an antenna curtain 320. The presence of the curtain 320 insures that the object moving through the portal structure 10 does not physically contact and possibly damage the antenna loop 300. As seen in FIG. 2, the antenna loop 300 is held within a fold of the curtain 320 by double-stitch sewing 322. Any other suitable securing means for securing the antenna loop 300 within the curtain 320 may be used.

In the present embodiment, the curtain 320 is made of any suitable flexible material, such as a nylon reinforced vinyl.

The curtain 320 is secured to a rigid frame 330 of the portal structure 10 by a bolt 332, attachment bar 326 and lockwasher 334, as seen in FIG. 4. The frame 330 may be secured to the ceiling of the building in which the portal structure is housed to insure that the portal structure 10 remains stationary. The curtain 320 hangs on each side of the portal structure 10, secured on each side at the top to the frame 330 in the manner shown in FIG. 4.

Each side of the curtain 320 is free-hanging at the bottom, i.e., each side of the curtain is not attached to any frame structure at the bottom. This free-hanging feature is particularly useful when animals pass through the portal structure 10 because the free-hanging curtain prevents the animal from damaging the antenna loop 300 or the portal structure 10 with a kick or other movement. If the animal does kick the curtain 320, the curtain 320 will swing away, pivoted only at the top where it is attached to the frame 330. It has been found that a free-hanging portal structure such as that shown in FIGS. 1-4 is less costly, requires less maintenance and has a longer service life than a rigid portal structure.

Stiffener plates 340 (one of which is shown in FIG. 3) are positioned in each of pocket flaps 350 of the curtain 320. The stiffener plates 340 help strengthen the curtain 320 and also result in a more stable hanging of the curtain 320. The stiffener plates 340, which in the present embodiment are made of polypropylene, do not interfere unduly with the flexible aspect of the curtain 320.

In the present embodiment, the AEC 400 is secured to the top of the frame 330 of the portal structure 10 as shown in FIG. 1. The AIU 500, since it is connected to

CHART I		
Symbol	Value	Description
R1	47K	Resistor
R3,R7,R4	1K	Resistor
R11,R17	1K	Resistor
R2,R8,R23,R25	10K	Resistor
R19,R26	330	Resistor
R29	330	Resistor
R5	2.2K	Resistor
R9	1K	Resistor
R10,R15	100K	Resistor
R13	3.3K	Resistor
R14	56K	Resistor
R16	680	Resistor
R18	10	Resistor
R20	39K	Resistor
R21	3.9K	Resistor
R24	470K	Resistor
R27	470	Resistor
R22	1K	Variable resistor
C1	10 pf	Capacitor
C2	22 pf	Capacitor
C3,C4,C10	.1 mfd	Capacitor
C23,C25	.1 mfd	Capacitor
C8,C19	4.7 mfd	Tantalum capacitor
C9	.033 mfd	Capacitor
C11	22 mfd	Capacitor
C12	.0022 mfd	Capacitor
C13,C20	.0022 mfd	Capacitor
C22,C5	.0022 mfd	Capacitor
C14,C16	.01 mfd	Capacitor
C17,C21	.01 mfd	Capacitor
C15,C26	.22 mfd	Capacitor
C18	.001 mfd	Capacitor
C24	.047 mfd	Capacitor
C31	.0022 mfd	Capacitor
Q1,Q3,Q4,Q6	2N2222A	Transistor
Q5	2N2906A	Transistor
Q2	IRF730	MOSFET transistor
CR2	4.7 volt	Zener diode
D1,D3,D4,D6	IN4444	Silicon diode
D5	HBR130P	Schottky diode
IC1	74HC00N	Integrated circuit
IC2	74HC4024N	Integrated circuit

the AEC 400 only by buses 520 and 540, may be located any convenient distance from the portal structure 10.

An additional feature of the identification system of the present invention is the apparatus for sensing the presence and the direction of movement of an object moving through the portal structure 10. In the FIG. 1 embodiment, the sensing apparatus includes an entrance detector 600 and an exit detector 700. Detectors 600 and 700 are both controlled by the AIU 500.

The entrance detector 600 and the exit detector 700 are identical in operation, and therefore only the detector 600 will be described. The detector 600 includes an ultra-sonic transducer (not shown) which transmits and receives ultra-sonic signals. When instructed by the AIU 500 along control bus 510, the entrance detector 600 will turn on and emit a short-burst, cone-shaped pattern of ultra-sonic sound waves. If an object is present within the cone, the sound wave will echo back and be received by the transducer. The received reflected ultra-sonic waves are converted to an electrical detection signal by the detector 600 and transmitted to the AIU 500 along bus 550.

Because the AIU 500 only monitors the detector 600 along bus 550 for a short period of time after the transducer emits the ultra-sonic waves, sound waves which echo back to the transducer from the floor will not echo back to the transducer in time to be noted by the AIU 500. Thus, the entrance detector 600 will only signal the presence of an object if in fact the object is within the cone emitted by the transducer of the detector 600. The exit detector 700 operates in the same fashion as the entrance detector 600, receiving control signals from the AIU 500 along control bus 530 and sending a detection signal to the AIU along bus 570.

By monitoring the entrance detector 600 and the exit detector 700, the AIU 500 can determine the presence of an object even without a signal from the transponder 200. Also, the direction of movement of the object through the portal structure 10 may be determined.

Having a method to sense the presence of an object, separate from the identification signal from the transponder 200, is of value. For instance, if a cow without a transponder or with an inoperative or defective transponder passes through the portal structure 10, the detectors 600 and 700 will indicate that an object is present even though no transponder signal is received. Knowing that a cow has passed through the portal structure 10, the AIU 500 can make sure that the milk output from that cow is not incorrectly assigned to another cow.

Information concerning the direction of movement is also useful, as a cow may become disoriented and walk back through the portal structure 10 instead of to the milking area. Noting a reverse direction of movement would confirm that a repeat identification signal from the transponder 200, indicating the repeat presence of the same cow in the portal structure 10, is not in error.

The AIU 500, which in the present embodiment is a single board micro-computer based on the 8749H Intel computer chip, controls the AEC 400 and the detectors 600 and 700. The operation in the present embodiment of the AIU 500, in the context of a milking parlor, is shown in the flow charts, FIGS. 9-11.

The AIU 500 first determines whether cows are approaching the portal structure 10, for example by moni-

toring whether an entrance gate (not shown) leading to the portal structure 10 is open. If the entrance gate is open, the AIU 500 sends a control signal to the AEC 400 along control bus 520 directing the AEC 400 power the antenna loop 300 and thus create the electromagnetic field necessary to energize the transponder 200, in the manner previously described.

After a certain delay period, the AIU 500 outputs a second control signal to the AEC 400 along control bus 520 instructing the AEC 400 to remove the electromagnetic field. The AIU 500 will then monitor data bus 540 to see if the AEC is sending a signal along that bus, indicating that the AEC 400 has received a signal from the transponder 200.

If the AIU 500 determines that a signal on data bus 540 is a valid transponder signal the AIU 500 will decode this transponder signal. After the signal is decoded, the AIU 500 will send a signal on bus 510 instructing the entrance detector 600 to turn on. If the AIU determines there is not a valid transponder signal on bus 540 the AIU 500 will also send a signal on bus 510 instructing the entrance detector 600 to turn on. After a specified period, a signal is sent by the AIU 500 along bus 510 instructing the entrance detector 600 to turn off and the AIU 500 monitors bus 550 to determine if the detector 600 has detected the presence of an object. The AIU 500 then in similar fashion sends a signal on bus 530 instructing the exit detector 700 to turn on. After a specified period, a signal is sent by the AIU 500 along bus 550 instructing the exit detector 700 to turn off and the AIU 500 monitors bus 570 to determine if the detector 700 has detected the presence of an object. Based on an analysis of three signals, (1) the signal (if any) from the AEC 400 along data bus 540, (2) the signal (if any) from entrance detector 600 along bus 550 and (3) the signal (if any) from detector 700 along bus 570, the AIU 500 determines if a cow which can be identified has moved in the proper direction through the portal structure 10 to the milking area. If a cow has been identified, the milk output will then be assigned to the correct cow by a parlor computer (not shown) which is connected to the AIU 500.

If the combination of signals indicate some unexpected occurrence, e.g., no valid transponder signal, no exiting from the portal structure 10, incorrect direction of movement through the portal structure 10, a sequential repeat of transponder codes, a valid transponder identification but no signals from the detectors 600 or 700, etc., the AIU 500 will take appropriate action to insure that the milk output is not assigned to the wrong cow. Also, the AIU 500 can alert the milking parlor operator to the problems through audio and visual alarms or the like.

Multiple electronic identification systems of the present invention may be used for large scale identification operations, where all AIU units, each having a separate portal structure and AEC unit, are interconnected and a parlor computer controls all of the AIU units.

A detailed software listing for the flow chart of FIGS. 9-11 is attached hereto as Appendix A, and is part of the written disclosure of this application.

It will be understood that the identification system of the present invention is not limited to the embodiment described above, but rather is defined by the following claims.

APPENDIX A

P48 :F4:PRTPAT.ASM

IS-II MCS-48/LP-I-41 MACRO ASSEMBLER, V4.0

LOC	OBJ	LINE	SOURCE STATEMENT
		1	*PAGEWIDTH(80) PAGELENGTH(56)
		2	;PORTAL ID PROGRAM
		3	;
		4	;PROGRAM NAME PORTNT.ASM PORTAL ID UNIT
		5	;
		6	*****
		7	**
		8	** PORTAL ID UNIT **
		9	** 8304479-02 **
		10	** REV B **
		11	** T. TOWNSEND AND C. MOORE **
		12	** APR. 1986 **
		13	**
		14	*****
		15	;
		16	;
		17	*****
		18	;
		19	*****
		20	CONSTANTS
		21	*****
00FB		22	UARTCA EQU -0FBH ;USART COMMAND ADDRESS
00FA		23	UARTDA EQU 0FAH ;USART DATA ADDRESS
009A		24	UARTMD EQU 0SAH ;USART MODE WORD
0015		25	UARTCM EQU 15H ;USART COMMAND WORD
0000		26	KEYCMD EQU 00H ;8279 COMMAND WORD
0020		27	KEYPSC EQU 80H ;8279 FRESCALER
00D0		28	KEYBLK EQU 0D0H ;8279 BLANKING COMMAND
00FD		29	KEYCA EQU 0FDH ;8279 CONTROL ADDRESS
00FC		30	KEYDA EQU 0FCH ;8279 DATA ADDRESS
007F		31	RAMT EQU 7FH ;TOP OF DATA MEMORY
0042		32	TIMEL EQU 6E ;DISPLAY TIME LOW
00F5		33	TIMEH EQU 245 ;DISPLAY TIME HIGH
0090		34	DSCMD EQU 90H ;WRITE DISPLAY CMD
0007		35	DSEL EQU 07H ;DEVICE DESELECT CMD
FFB3		36	IDTIME EQU -125 ;ID TIME (10 MSEC)
00FF		37	ON EQU 0FFH ;IDU ON COMMAND
0000		38	OFF EQU 0 ;IDU OFF COMMAND
FFC4		39	GDLY EQU -E0 ;GATE DELAY
00FF		40	OPEN EQU 0FFH ;GATE OPEN STATUS
0000		41	CLOSED EQU 0 ;GATE CLOSED STATUS
		42	DNCTN EQU -2 ;NUMBER OF ON COUNTS

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A conformed copy of the first page of Appendix A containing the above legend is attached hereto.

0040	47	PWRLIT EQU 40H	;POWER LIGHT LED #E
00E0	48	SLIGHT EQU 20H	;GATE LIGHT LED #E
FFF0	49	CNT1 EQU -3	;IDLE TIME = 3 SECONDS
FFD3	50	CNT2 EQU -45	;IDLE TIMER SECONDARY
	51	;	
	52	-----	
	53	;	DATA MEMORY
	54	-----	
0000	55	REGB0: DS 8	;R0-R7 MAIN REGISTER BANK
0008	56	STACK: DS 16	;STACK MEMORY SYSTEM
0018	57	REGB1: DS 8	;R0' - R7' ALT REGISTER BANK
0020	58	IDADD: DS 1	;IDU ADDRESS LOCATION

0021	59	BCNT:	DS	1	;BREQ COUNTER
0022	60	OUTBUF:	DS	6	;UART OUTPUT DATA BUFFER
0028	61	OLDBUF:	DS	6	;OLD OUTPUT BUFFER
002E	62	DSBUF:	DS	6	;DISPLAY BUFFER
0034	63	INPTR:	DS	1	;INPUT BUFFER POINTER
0035	64	INBUF:	DS	6	;INPUT BUFFER
0038	65	CLKTIM:	DS	1	;CYCLE TIMER
003C	66	UARTL:	DS	2	;SERIAL PREAMBLE & DATA UART
003E	67	PREAMB:	DS	1	;PREAMBLE FLAG
003F	68	DATLOW:	DS	2	;TRANS. RAW DATA
0041	69	BCDPTR:	DS	2	;TRANS. BCD DATA
0043	70	BINPTR:	DS	2	;TRANS. BINARY DATA
0045	71	PARITY:	DS	1	;TRANS. PARITY FLAG
004E	72	NEWDAT:	DS	2	;NEW DATA POINTER
004B	73	OLDDAT:	DS	2	;OLD DATA BUFFER
004A	74	IDCNTL:	DS	1	;ID CONTROL FLAG LOCATION
004B	75	DVALID:	DS	1	;DATA VALID FLAG
004C	76	HFBIT:	DS	1	;HALF BIT FLAG
004D	77	IDBUF:	DS	32	;IDBUFFER
00ED	78	IDQUE:	DS	1	;ID POINTER QUE
00EE	79	BLCNT:	DS	1	;BLANK TIME COUNTER
00EF	80	STATUS:	DS	1	;STATUS LIGHTS
0070	81	DFLAG:	DS	1	;DETECT FLAG
0071	82	DSTAT:	DS	1	;DISPLAY STATUS BUFFER
0072	83	PSTATE:	DS	1	;PREVIOUS STATE BUFFER
0073	84	FAILB:	DS	1	;DETECT FAILURE BUFFER
0074	85	PRESST:	DS	1	;PRESENT STATUS
0075	86	TRCNTR:	DS	1	;TRANSPONDER LOSS COUNTER
0076	87	IDFLG:	DS	1	;ID FLAG
0077	88	DTIME:	DS	1	;DETECT TIMER
0078	89	; NOTE: THESE LOCATION MUST REMAIN SEQUENTIAL			
0079	90	ONDLY1:	DS	1	;SONAR #1 ON DELAY
007A	91	ONDLY2:	DS	1	;SONAR #2 ON DELAY
007B	92	OFDLY1:	DS	1	;SONAR #1 OFF DELAY
007C	93	OFDLY2:	DS	1	;SONAR #2 OFF DELAY
007D	94	IDLECT:	DS	1	;IDLE TIMER
007D	95	IDLEC2:	DS	1	;IDLE TIMER (SECONDARY)
007D	96	:			
007D	97				
007D	98	EJECT			
007D	99	:			
007D	100	:			
007D	101	:			
007D	102	:			START OF INIT
007D	103	:			
000	104	ORG	00H		
000 0409	105	JMP	START		;RESTART ADDRESS
003	106	ORG	03H		;EXT INT ROUTINE
003 04FD	107	JMP	EXTINT		
007	108	ORG	07H		;INT TIMER INIT
007 2400	109	JMP	TIMINT		;ROUTINE
007D	110	:			
007D	111	:			
0009 C5	112	START:	SEL	R80	
000A 75	113	ENT0	CLK	,	
000B 2300	114	MOV	A, #00		
000D D7	115	MOV	PSW, A		
000E 37	116	CPL	A		
000F 3A	117	OUTL	P2, A		
0010 39	118	OUTL	P1, A		
0011 00	119	NOP			
0012 00	120	NOP			
0013 00	121	---	NOP		
0014 9AF7	122	ANL	P2, #0F7H		
0015	123	----	CLEAR ALL RAM-----		
0016 887F	124	STRT1:	MOV	R0, #RAMT	
0018 BASE	125	MOV	R2, #RAMT-33		
001A 2300	126	MOV	A, #00		
001C A0	127	CLRDAT:	MOV	0R0, A	
001D C8	128	DEC	R0		
001E EA1C	129	DJNZ	R2, CLRDAT		
0020 9AF3	130	INIT51:			
0022 2300	131	ANL	P2, #0F3H		
0022 2300	132	MOV	A, #00H		

0024 91	133	MOVX	OR1,A	
0025 91	134	MOVX	OR1,A	
0026 91	135	MOVX	OR1,A	
0027 2340	136	MOV	A,#40H	
0029 91	137	MOVX	OR1,A	
002A 239A	138	MOV	A,#09AH	
002C 91	139	MOVX	OR1,A	; INITIALIZE B251
002D 2315	140	MOV	A,#15H	
002F 91	141	MOVX	OR1,A	
0030 00	142	NOP		
0031 00	143	NOP		
0032 BA07	144	ORL	P2, #DSEL	
	145 ;			
0034 9AFD	146 INIT79:	ANL	P2, #KEYCA	; INITIALIZE B79
0036 2300	147	MOV	A, #KEYCMD	
0038 91	148	MOVX	OR1,A	
0039 2320	149	MOV	A, #KEYFSC	
003B 91	150	MOVX	OR1,A	
003C 23D0	151	MOV	A, #KEYBLK	
003E 91	152	MOVX	OR1,A	
003F BA07	153	ORL	P2, #DSEL	; DESELECT DEVICE
0041 05	154	EN	I	
0042 B821	155	MOV	R0, #BCNT	
0044 B0FA	156	MOV	@R0, #0FAH	; INIT BREQ COUNTER
0046 B84A	157	MOV	R0, #IDCNTL	
0048 B0FF	158	MOV	@R0, #ON	; SET ID CONTROL ON
004A B8EE	159	MOV	R0, #BLCNT	
004C B0D3	160	MOV	@R0, #BCOUNT	; INIT BLANK COUNTER
004E BC20	161	MOV	R4, #32	
0050 B84D	162	MOV	R0, #IDBUF	
0052 B0FF	163 IDCLR:	MOV	@R0, #0FFH	; CLEAR IDBUFFER
0054 18	164	INC	R0	
0055 EC52	165	DJNZ	R4, IDCLR	
0057 B86D	166	MOV	R0, #IDQUE	
0059 B000	167	MOV	@R0, #0	; CLEAR POINTER
005B B871	168	MOV	R0, #DSTAT	
005D B004	169	MOV	@R0, #04H	; CLEAR DETECT STATUS
005F B874	170	MOV	R0, #PRESS1	; LIGHTS AND TURN ON
0061 B000	171	MOV	@R0, #00	; POWER LIGHT
0063 B872	172	MOV	R0, #PSTATE	
0065 B001	173	MOV	@R0, #01H	; PREVIOUS STATE = 1
0067 B875	174	MOV	R0, #TRCNTR	; FOR START-UP
0069 B0FE	175	MOV	@R0, #TRCNT	; TRANSPOUNDER COUNTER
006B B873	176	MOV	R0, #FAILB	; SET FAILED BUFFER
006D B000	177	MOV	@R0, #00H	
006F B877	178	MOV	R0, #DTIME	
0071 B0FE	179	MOV	@R0, #DCOUNT	
0073 B878	180	MOV	R0, #ONDLY1	
0075 B0FE	181	MOV	@R0, #ONCNT	
0077 18	182	INC	R0	
0078 B0FE	183	MOV	@R0, #ONCNT	
007A 18	184	INC	R0	
007B B0FE	185	MOV	@R0, #OFCNT	; INITIALIZE COUNTERS
007D 18	186	INC	R0	
007E B0FE	187	MOV	@R0, #OFCNT	
0080 B87C	188	MOV	R0, #IDLECT	
0082 B0FD	189	MOV	@R0, #CNT1	; INITIALIZE SHME LOW
0084 B87D	190	MOV	R0, #IDLEC2	; TIMER
0086 B0D3	191	MOV	@R0, #CNT2	
0088 B400	192	CALL	BLKDIS	; CLEAR DISPLAY AND
	193 ;			; CHECK SONAR
	194 ;			
	195 ;			
	196 ; START FOREGROUND ROUTINES			
	197 ;-----			
	198 ;-----			
	199 ; FOREGROUND ROUTINES			
	200 ;-----			
	201 ;			
	202 FORE:			
008A B8EE	203	MOV	R0, #BLCNT	
008C 10	204	INC	@R0	
008D F0	205	MOV	A, @R0	
008E 9694	206	JNZ	FORE	

0090 B0D3	207	MOV	R0, #BCOUNT	
0092 B400	208	CALL	BLKDIS	
0094 B493	210	CALL	IDTST	
009E 94B9	211	CALL	GTEST	
0098 FC	212	MOV	A, R4	
0099 C6A6	213	JZ	FORE0A	
009B 54B7	214	CALL	DELAY	
009D B846	215	MOV	R0, #NEWDAT	
009F B099	216	MOV	R0, #99H	
00A1 18	217	INC	R0	
00A2 B099	218	MOV	R0, #99H	
00A4 048A	219	JMP	FORE	
00A6 99BF	220	ANL	P1, #0BFH	
00A8 00	221	NOP		
00A9 00	222	NOP		
00AA 9AFB	223	ANL	P2, #UARTCA	
00AC BC14	224	FOREA:	MOV R4, #20	
00AE B1	225	FOREB:	MOVX A, @R1	
00AF 37	226	CPL	A	
00B0 F2AC	227	JB7	FOREA	
00B2 ECAE	228	DJNZ	R4, FOREB	
00B4 BA07	229	ORL	P2, #DSEL	
00B6 993F	230	ANL	P1, #3FH	
00B8 B940	231	ORL	P1, #40H	
00BA BD0E	232	FORE1:	MOV R5, #2	
00BC 94A6	233	FORE2:	CALL OUTST	
00BE EDBC	234	DJNZ	R5, FORE2	
00C0 B875	235	MOV	R0, #TRCNTR	
00C2 10	236	INC	@R0	
00C3 F0	237	MOV	A, @R0	
00C4 9ECE	238	JNZ	FORE3	
00C6 B0FE	239	MOV	R0, #TRCNTR	
00C8 B874	240	MOV	R0, #PRESST	
00CA F0	241	MOV	A, @R0	
00CB 53FE	242	ANL	A, #0FEH	
00CD A0	243	MOV	R0, A	
00CE B980	244	FORE3:	ORL P1, #80H	
00D0 E3FF	245	MOV	A, #0FFH	
00D2 62	246	MOV	T, A	
00D3 25	247	EN	TCNTI	
00D4 45	248	STRT	CNT	
00D5 BC05	249	MOV	R4, #05H	
00D7 54B7	250	CALL	DELAY	
00D9 35	251	DIS	TCNTI	
00DA 65	252	STOP	TCNT	
00DB D432	253	CALL	STTBL	
00DD B40E	254	CALL	DETECT	
00DF BC05	255	MOV	R4, #5	
00E1 54B7	256	CALL	DELAY	
00E3 048A	257	JMP	FORE	
00E5 9AEC	258	-----		
00E7 BC01	259	; READ IN I.D. ADDRESS SETTINGS		
00E9 54B7	260	PIN 17 SELECT LINE		
00EB 09	261	NO JUMPER - LEFT LOWER		
00EC 531C	262	JUMPER TO PIN 14 - LEFT UPPER		
00EE 77	263	15 - RIGHT LOWER		
00EF 72F9	264	16 - RIGHT UPPER		
00F1 4351	265	-----		
00F3 B820	266	-----		
00F5 A0	267	-----		
00F6 BA10	268	-----		
00F8 83	269	-----		
00F9 2306	270	CALL	DELAY	
00E5 9AEC	271	IN	A, P1	
00E7 BC01	272	ANL	A, #1CH	; MASK OFF ADDR BT15
00E9 54B7	273	RR	A	
00EB 09	274	JB3	RIGHTU	; IF RIGHT UPPER HANDLE
00EC 531C	275	ADDSET:	ORL A, #51H	; ADD 51H TO ADDRESS
00EE 77	276	MOV	R0, #IDADD	; STORE I.D. ADDRESS
00EF 72F9	277	MOV	R0, A	
00F1 4351	278	ORL	P2, #10H	; TURN-OFF SELECT
00F3 B820	279	RET		
00F5 A0	280	RIGHTU:	MOV A, #05H	; SPECIAL FOR RIGHT UPPER

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00FB 04F1 281     JMP     ADDSET
282 ;
283 ;-----
284 ;      EXTERNAL INTERRUPT ROUTINE
285 ;-----
286 ;
287 EXTINT:
288     DIS     1
289     RETR
290 ;
291
292 ;-----
293 ;      DATA INPUT INTERRUPT ROUTINE
294 ;-----
295 ;
0100 296     ORG     100H
297
0100 35 298     TIMINT: DIS    TENTI
0101 00 299     NOP
0102 BC01 300     MOV    R4, #1           ;RETURN WITH ONE COUNT
0104 D5 301     SEL    RB1,
0105 AF 302     MOV    R7, A
0106 00 303     NOP
0107 00 304     NOP
0108 00 305     NOP
0109 B84B 306     MOV    R0, #DVALID
010B B0FF 307     MOV    @R0, #0FFH       ;SET DATA VAL ID - TRUE
010D BC0C 308     MOV    R4, #1E          ;PREAMBLE = 1E BITS
010F 5400 309     CALL   RDWORD          ;READ PREAMBLE FRAME
0111 B94B 310     MOV    R1, #DVALID
0113 B83C 311     MOV    R0, #UARTL
0115 F0 312     MOV    A, @R0
0116 D3FF 313     XRL    A, #0FFH
0118 CE1C 314     JZ    TIMIN1          ;CHECK PREAMBLE VS. IDLE
011A B100 315     MOV    @R1, #0
011C 18 316     TIMIN1: INC   R0
011D F0 317     MOV    A, @R0
011E D3F0 318     XRL    A, #0F0H
0120 CEE4 319     JZ    TIMIN1
0122 B100 320     MOV    @R1, #0
0124 B805 321     TIMIN2: MOV   R3, #05          ;DELAY FOR 5 ETT TIME
0126 BA68 322     TIM2A:  MOV   R2, #107
0128 4E30 323     TIM2C: JNT1  TIM2B
012A EA28 324     DJNZ   R2, TIM2C        ;LOOP FOR START ETT
012C EB2E 325     DJNZ   R3, TIM2A        ;OR TIME-OUT
012E 24AD 326     JMP    TIMIN7
0130 BA0A 327     TIM2B: MOV   R2, #10
0132 EA32 328     DJNZ   R2, $             ;16 BITS IN DATA FRAME
0134 BC10 329     MOV    R4, #1E          ;16 BITS IN DATA FRAME
0136 5400 330     CALL   RDWORD          ;READ DATA FRAME
0138 B845 331     MOV    R0, #PARITY
013A F0 332     MOV    A, @R0
013B 5301 333     ANL    A, #01H
013D C645 334     JZ    TIMIN3
013F B84B 335     MOV    R0, #DVALID
0141 B000 336     MOV    @R0, #0
0143 24AD 337     JMP    TIMIN7
0145 B83C 338     TIMIN3: MOV   R0, #UARTL
0147 B944 339     MOV    R1, #BINPTR+1    ;CONVERT DATA TO BIN - 1
0149 F0 340     MOV    A, @R0
014A 537F 341     ANL    A, #7FH
014C 97 342     CLR    C
014D E7 343     RRC    A
014E A1 344     MOV    @R1, A
014F 18 345     INC    R0
0150 C9 346     DEC    R1
0151 F0 347     MOV    A, @R0
0152 E7 348     RRC    A
0153 A1 349     MOV    @R1, A
0154 B84B 350     MOV    R0, #DVALID
0156 F0 351     MOV    A, @R0
0157 9E55 352     JNZ    TIMIN4
0159 24AD 353     JMP    TIMIN7
015B B843 354     TIMIN4: MOV   R0, #BINPTR

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015D B941      355    MOV     R1, #BCDPTR
015F 547D      356    CALL    BINBCD
01E1 B841      357    MOV     R0, #BCDPTR
01E3 F400      358    CALL    DISPLAY
01E5 B842      359    MOV     R0, #BCDPTR+1
01E7 B947      360    MOV     R1, #NEWDAT+1
01E9 F0        361    MOV     A, @R0
01EA D1        362    XRL    A, @R1
01EB 9E75      363    JNZ    TIM6A
01ED C8        364    DEC    R0
01EE C9        365    DEC    R1
01EF F0        366    MOV     A, @R0
0170 D1        367    XRL    A, @R1
0171 9E75      368    JNZ    TIM6A
0173 249D      369    JMP    TIM6D
370 TIM6A:
0175 B873      371    MOV     R0, #FAILB
0177 F0        372    MOV     A, @R0
0178 9E91      373    JNZ    TIM6BA
374 TIM6B:
017A B876      375    MOV     R0, #IDFLG
017C B0FF      376    MOV     @R0, #0FFH;
017E B848      377    MOV     R0, #OLDDAT
0180 F0        378    MOV     A, @R0
0181 18        379    INC    R0
0182 40        380    ORL    A, @R0
0183 C693      381    JZ     TIM6C
0185 B874      382    MOV     R0, #PRESST
0187 B005      383    MOV     @R0, #05
0189 D485      384    CALL   ACFTID           ;ACCEPT PREVIOUS LOW NUM
BER
018B B872      385    MOV     R0, #FSTATE
018D B00E      386    MOV     @R0, #E           ;NEW STATE = E
018F 2493      387    JMP    TIMEC
388 TIMEBA:
0191 D493      389    CALL   ACPNEW          ;ACCEPT NEW TRANS *
0390             390    RETR
391 TIMEC:
0193 B946      392    MOV     R1, #NEWDAT
0195 B841      393    MOV     R0, #BCDPTR
0197 F0        394    MOV     A, @R0
0198 A1        395    MOV     @R1, A
0199 18        396    INC    R0
019A 19        397    INC    R1
019B F0        398    MOV     A, @R0
019C A1        399    MOV     @R1, A
400 TIM6D:
019D B875      401    MOV     R0, #TRCNTR
019F B0FE      402    MOV     @R0, #TRCNT          ;RESET TRANS LOSS
01A1 B874      403    MOV     R0, #PRESST          ;COUNTER
01A3 F0        404    MOV     A, @R0
01A4 4301      405    ORL    A, #01
01AE A0        406    MOV     @R0, A
01A7 D432      407    CALL   STTBL
01A9 B8EE      408    MOV     R0, #BLCNT
01AB B0D3      409    MOV     @R0, #BCOUNT
410 TIMIN7:
01AD FF        411    TIMIN8: MOV     A, R7
01AE 93        412    RETR
413 ;
414 -----
415 ;       DATA INPUT TEST ROUTINE
416 ;-----
417 ;
418
0078          419    COUNT2 EQU     120
420
421 INTST:
01AF BC00      422    MOV     R4, #0
01B1 BE78      423    MOV     R6, #COUNT2
01B3 BA07      424    INTS1: ORL    P2, #DSEL
01B5 9AF8      425    ANL    P2, #UARTCA
01B7 80        426    MOVX   A, @R0

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23

24

1B8 AA	427	MOV	R2, A	
1B9 37	428	CPL	A	
1BA 3EC6	429	JB1	INTS2	; INPUT DATA FENL
1BC 9AFA	430	ANL	P2, #UARTDH	; YES, READ BYTE
1BE 80	431	MOVX	A, GR0	
1BF AB	432	MOV	R3, A	; SAVE IN R3
1C0 FA	433	MOV	A, R2	
1C1 5338	434	ANL	A, #3BH	; TRANSMISSION ERROR
1C3 AA	435	MOV	R2, A	
1C4 BCFF	436	MOV	R4, #0FFH	; CHARACTER FLAG
1C6 BE01	437	MOV	R6, #1	
1CB 8A07	438 INTS2:	ORL	P2, #DSEL	
1CA EEE3	439	DJNZ	R6, INTS1	; WAIT FOR TIMEOUT
1CC FC	440	MOV	A, R4	; RETURN WITH DATA
1CD 83	441	RET		; FLAG IN ACC
	442			
	443			
0200	444	ORG	0200H	
	445			
	446			
0200 BA20	447 RDWORD:	ORL	P2, #20H	; SET PIN 18 HIGH
0202 B84C	448	MOV	R0, #HFBIT	
0204 B000	449	MOV	@R0, #0	
0206 B845	450	MOV	R0, #PARITY	; INITIALIZE PARITY
0208 B00E	451	MOV	@R0, #0	
020A B83C	452	MOV	R0, #UARTL	
020C B000	453	MOV	@R0, #0	
020E 18	454	INC	R0	; INITIALIZE SERIAL TIME
020F B000	455	MOV	@R0, #0	; WORD
0211 BA0F	456	MOV	R2, #15	
0213 EA13	457	DJNZ	R2, \$; DELAY FOR 1/4 BIT TIME
0215 461D	458	JNT1	RDWD1	
0217 B84B	459	MOV	R0, #DVALID	
0219 B000	460	MOV	@R0, #0	
021B 4447	461	JMP	RDWD4	
021D 544A	462 RDWD1:	CALL	RDBIT	
021F 1227	463	JBO	RDWD2	
0221 B84B	464	MOV	R0, #DVALID	; CHECK FOR VALID
0223 B000	465	MOV	@R0, #0	; MANCHESTER DATA BIT
0225 4447	466	JMP	RDWD4	
0227 E62C	467 RDWD2:	JNC	RDWD3	
0229 B845	468	MOV	R0, #PARITY	
022B 10	469	INC	@R0	
022C B83C	470 RDWD3:	MOV	R0, #UARTL	
022E F0	471	MOV	A, @R0	
022F E7	472	RRC	A	
0230 A0	473	MOV	@R0, A	
0231 18	474	INC	R0	
0232 F0	475	MOV	A, @R0	
0233 E7	476	RRC	A	
0234 A0	477	MOV	@R0, A	
0235 BA3E	478	MOV	R2, #EE	; DELAY FROM 1/2
0237 EA37	479	DJNZ	R2, \$; BIT TIMES
0239 545D	480	CALL	RDBIT	; READ HALF BIT DATA
023B B84B	481	MOV	R0, #DVALID	
023D F0	482	MOV	A, @R0	
023E C647	483	JZ	RDWD4	
0240 00	484	NOP		
0241 BA47	485	MOV	R2, #71	
0243 EA43	486	DJNZ	R2, \$; DELAY ANOTHER 1/2 B.
0245 EC1D	487	DJNZ	R4, RDWD1	; READ REST OF DATA
0247 9ADF	488 RDWD4:	ANL	P2, #0DFH	; SET PIN 18 LOW
0249 83	489	RET		
	490			
024A B84C	491 RDBIT:	MOV	R0, #HFBIT	
024C 2300	492	MOV	A, #0	
024E 9ADF	493	ANL	P2, #0DFH	; BENCHMARK FLAG
0250 97	494	CLB	C	
0251 A7	495	CPL	C	
0252 4655	496	JNT1	RDBIT1	
0254 97	497	CLR	C	
0255 F7	498 RDBIT1:	RLC	A	
0256 BA20	499	ORL	P2, #20H	; BENCHMARK FLAG
0258 A9	500	MOV	R1, A	

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25

0259 E7 501 RRC A
 025A F0 502 MOV A, @R0
 025B D9 503 XRL A, R1
 025C 83 504 RET
 505

506 RDHBIT:

025D B84C 507 MOV R0, #HFBIT
 025F B000 508 MOV @R0, #0
 0261 9ADF 509 ANL P2, #0DFH
 0263 BA20 510 ORL P2, #20H
 0265 5EEA 511 JT1 RDHB1
 0267 B001 512 MOV @R0, #01
 0269 B3 513 RET
 026A 00 514 RDHB1: NOP
 026B 00 515 NOP
 026C B3 516 RET
 517

518 BUSFRE:

026D B3 519 RET
 520 ;
 521 ;

522 ;

523 ;-----

524 ; TEST FOR LEADING ZERO'S FOR DISPLAY

525 ;-----

526 ;

527 BNKTST:

026E BA03 528 MOV R2, #03H ;TEST FOR LEADING
 0270 B831 529 MOV R0, #DSBUF+3 ;ZEROES
 0272 F0 530 BKTST1: MOV A, @R0
 0273 D33F 531 XRL A, #3FH
 0275 9E7C 532 JNZ BKTST2
 0277 B000 533 MOV @R0, #00H ;CHANGE TO "BLANK"
 0279 C8 534 DEC R0
 027A EA72 535 DJNZ RE, BKTST1
 027C B3 536 BKTST2: RET

537 ;

538 ;-----

539 ; BINBCD -- CONVERTS TRANSPONDER TO BCD

540 ;-----

541 ;

542 BINBCD:

027D B100 543 MOV @R1, #0 ;CLR BCD POINTER
 027F 19 544 INC R1
 0280 B100 545 MOV @R1, #0 ;LOCATION
 0282 BA10 546 MOV R2, #16 ;16 BITS TO CONVERT
 0284 18 547 INC R0
 0285 C8 548 BIN1: DEC R0
 0286 C9 549 DEC R1
 0287 97 550 CLR C
 0288 F0 551 MOV A, @R0
 0289 F7 552 RLC A
 028A A0 553 MOV @R0, A
 028B 18 554 INC R0
 028C F0 555 MOV A, @R0
 028D F7 556 RLC A
 028E A0 557 MOV @R0, A
 028F F1 558 MOV A, @R1
 0290 71 559 ADDC A, @R1
 0291 57 560 DA A
 0292 A1 561 MOV @R1, A
 0293 19 562 INC R1
 0294 F1 563 MOV A, @R1
 0295 71 564 ADDC A, @R1
 0296 57 565 DA A
 0297 A1 566 MOV @R1, A
 0298 EA85 567 DJNZ RE, BIN1
 029A B3 568 RET
 569
 570

571 ;-----

572 ; POP ROUTINE

573 ;-----

574

26

;RET WITH BIT IN CARRY
 ;A = 1 FOR VALID DATA

575 POP:

```

029E BA1C      576    MOV     R2, #2B
029D BB4D      577    MOV     R0, #IDBUF
029F BB4F      578    MOV     R1, #IDBUF+2
02A1 F1        579 POP1: MOV     A, @R1
02A2 A0        580    MOV     @R0, A      ;POP OFF ISI NUMBER
02A3 18        581    INC     R0
02A4 19        582    INC     R1
02A5 EA11      583    DJNZ   R2, POP1
02A7 B0FF      584    MOV     @R0, #0FFFH
02A9 18        585    INC     R0
02AA B0FF      586    MOV     @R0, #0FFFH
02AC B8ED      587    MOV     R0, #IDQUE
02AE F0        588    MOV     A, @R0
02AF C6B5      589    JZ    POP2
02B1 07        590    DEC    A      ;RESET DUE POINTER
02B2 C6B5      591    JZ    POP2
02B4 07        592    DEC    A
02B5 A0        593 POP2: MOV     @R0, A
02B6 B3        594    RET
595
596 ;-----
597 ; 1 MSEC DELAY
598 ; ON ENTRY R4 HOLDS NUMBER OF MSEC FOR DELAY
599 ;-----
600
601 DELAY:
02B7 00        602    NOP
02B8 00        603    NOP
02B9 BEA7      604    MOV     R4, #1E7      ;1 MSEC DELAY
02BB FEBB      605    DJNZ   R4, *
02BD 00        606    NOP
02BE 00        607    NOP
02BF ECB7      608    DJNZ   R4, DELAY      ;NUMBER OF MSEC
02C1 B3        609    RET
610
611 ;-----
612 ; RSTAT-- RESET ZONE1 OR ZONE2 STATUS FLAG
613 ; R4 CONTAINS BIT MASK
614 ;-----
615 ;
616
617 RSTAT:
02C2 BB74      618    MOV     R0, #PRESST
02C4 F0        619    MOV     A, @R0
02C5 5C        620    ANL    A, R4      ;RESET APP. BIT
02C6 A0        621    MOV     @R0, A
02C7 D432      622    CALL   STTBL      ;UPDATE STATE TABLE
02C9 B3        623    RET
624
625 ;-----
626 ; SSTAT-- SETS ZONE1 OR ZONE2 STATUS FLAGS
627 ; R4 CONTAINS BIT TO BE SET
628 ;-----
629 ;
630 SSTAT:
02CA BB74      631    MOV     R0, #PRESST
02CC F0        632    MOV     A, @R0
02CD 4C        633    ORL    A, R4      ;SET APP. BIT
02CE A0        634    MOV     @R0, A
02CF D432      635    CALL   STTBL      ;UPDATE STATE TABLE
02D1 B3        636    RET
637
638 ;-----
639 ; SONAR TEST
640 ; TEST FOR DEFECTIVE SONAR DETECTOR
641 ;-----
642 ;
643 STEST:
02D2 BB73      644    MOV     R0, #FAILB
02D4 B0FF      645    MOV     @R0, #0FFFH
02D6 9A3F      646    ANL    P2, #3FH

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02D8 00	647	NOP	
02D9 00	648	NOP	
02DA 09	649	IN A, P1	
02DB 37	650	CPL A	
02DC 5303	651	ANL A, #03H	;LOOK FOR MISSING DR
02DE 96ED	652	JNZ STEST1	;LOCK-UP OF EITHER
02E0 BAC0	653	ORL P2, #0C0H	;SONAR
02E2 BC14	654	MOV R4, #20	;LOOK FOR ECHO UP TO
02E4 54B7	655	CALL DELAY	;15 FEET
02E6 09	656	IN A, P1	
02E7 9A3F	657	ANL P2, #3FH	;TURN OFF BOTH SONARS
02E9 5303	658	ANL A, #03	
02EB C6F1	659	JZ STEST2	;CHECK FOR RESPONSE FROM
	660		;BOTH SONARS
	661 STEST1:		
02ED B873	662	MOV R0, #FAILB	
02EF B0FF	663	MOV @R0, #0FFH	;FAILED SET FLAG
02F1 B3	664 STEST2:	RET	
0400	665		
	666	ORG 0400H	
	667		
	668		
	669	----- DECODE-- INPUT DECODE ROUTINE	
	670	FROM PARLOR CONTROLLER	
	671		
	672		
	673 DECODE:		
0400 BC0F	674	MOV R4, #15	
0402 FA	675 DECO1:	MOV A, R2	
0403 9E5B	676	JNZ DECO4	
0405 FB	677	MOV A, R3	
0406 37	678	CPL A	
0407 125B	679	JB0 DECO4	;CHECK FOR ADDRESS ERRE
0409 FB	680	MOV A, R3	
040A B820	681	MOV R0, #IDADD	;OWN ADDRESS?
040C D0	682	XRL A, @R0	
040D 965B	683	JNZ DECO4	
040F 34AF	684	CALL INTST	;WAIT FOR BUS FREE
0411 BC0C	685	MOV R4, #12	;MESSAGE
0413 C65B	686	JZ DECO4	
0415 FA	687	MOV A, R2	
0416 9E5B	688	JNZ DECO4	
0418 FB	689	MOV A, R3	
0419 D37E	690	XRL A, #7EH	
041B CEE4	691	JZ DECO0	;BUS FREE OUTPUT TO D4H
041D FB	692	MOV A, R3	
041E D378	693	XRL A, #78H	;CHECK FOR REPEAT FROM
0420 C64C	694	JZ DECO2B	;PC REPEAT, OUTPUT SAME
0422 845B	695	JMP DECO4	;VALUE ELSE ABORT
0424 B822	696 DECO0:	MOV R0, #OUTBUF	
0426 B920	697	MOV R1, #IDADD	
0428 F1	698	MOV A, @R1	
0429 A0	699	MOV @R0, A	
042A 18	700	INC R0	
042B B00E	701	MOV @R0, #0EH	
042D 18	702	INC R0	
042E B94D	703	MOV R1, #IDBUF	
0430 F1	704	MOV A, @R1	
0431 530F	705	ANL A, #0FH	
0433 E7	706	RL A	
0434 A0	707	MOV @R0, A	
0435 18	708	INC R0	
0436 F1	709	MOV A, @R1	
0437 53F0	710	ANL A, #0F0H	
0439 47	711	SWAP A	
043A E7	712	RL A	
043B A0	713	MOV @R0, A	
043C 18	714	INC R0	
043D 19	715	INC R1	
043E F1	716	MOV A, @R1	
043F 530F	717	ANL A, #0FH	
0441 E7	718	RL A	

0442 A0	719	MOV	R0,A	
0443 18	720	INC	R0	
0444 F1	721	MOV	A,R1	
0445 53F0	722	ANL	A,#0F0H	
0447 47	723	SWAP	A	
0448 E7	724	RL	A	
0449 A0	725	MOV	R0,A	
044A 94E7	72E DECO2:	CALL	XFER	; TRANSFER OUTPUT BUFFER ; TO OLDBUFFER
	727			
044C B00E	728 DECO2B:	MOV	R2,#E	
044E B022	729	MOV	R0,#OUTBUF	; TRANSMIT ID DATA
0450 F430	730	CALL	XMIT	
0452 34AF	731	CALL	INTST	; CHECK FOR REPEAT
0454 BC01	732	MOV	R4,#1	; REQUEST FROM PC
045E 9602	733	JNZ	DECO1	
0458 549B	734	CALL	POP	; INFO RECEIVED, ; POP STACK
045A B3	735	RET		; POP ID OFF STACK
045B 54B7	736 DECO4:	CALL	DELAY	
045D B3	737 DECO5:	RET		
	738			
	739			
045E B04A	740 TURNON:	MOV	R0,#IDCNTL	
0460 B0FF	741	MOV	R0,#ON	
0462 B04A	742 TNOFF:	MOV	R0,#IDCNTL	
0464 B000	743	MOV	R0,#OFF	
0466 B3	744	RET		
	745			
0467 B022	746 XFER:			
0469 B928	747	MOV	R0,#OUTBUF	
046B BA0E	748	MOV	R1,#OLDBUF	
046D F0	749	MOV	R2,#6	
046E A1	750 XFER1:	MOV	A,R0	
046F EAED	751	MOV	R1,A	
0471 B3	752	DJNZ	R2,XFER1	
	753	RET		
	754			
	755 ;-----			
	756 ;-----	DATOUT--DATA OUTPUT ROUTINE		
	757 ;-----			
	758			
00A5	759 COUNT	EQU	165	; BUS QUIET BASE TIME
00FA	760 COUNT1	EQU	250	; 3 SEC TIMEOUT FOR XFER
	761			
	762 DATOUT:			
0472 14E5	763	CALL	CAL	
0474 B000	764	MOV	R0,#IDADD	
0476 F0	765	MOV	A,R0	
0477 77	766	RR	A	
0478 5303	767	ANL	A,#03	
047A AA	768	MOV	R2,A	
047B 1A	769	INC	R2	
047C 23A5	770	MOV	A,#COUNT	
047E 0305	771 DAT1:	ADD	A,#05	
0480 EA7E	772	DJNZ	R2,DAT1	
0482 AB	773	MOV	R3,A	
0483 BCFA	774	MOV	R4,#COUNT1	
0485 ECB9	775 DAT2:	DJNZ	R4,DAT2A	
0487 B4A1	776	JMP	DAT5	
0489 FB	777 DAT2A:	MOV	A,R3	
048A AA	778	MOV	R2,A	
048B B085	779 DAT3:	JNI	DAT2	
048D 00	780	NOP		
048E 00	781	NOP		
048F 00	782	NOP		
0490 00	783	NOP		
0491 EA8E	784	DJNZ	R2,DAT3	
0493 B000	785	MOV	R0,#IDADD	
0495 BA01	786	MOV	R2,#1	
0497 F430	787	CALL	XMIT	
0499 34AF	788 DAT4:	CALL	INTST	
049B CEA1	789	JZ	DAT5	
049D 9400	790	CALL	DECODE	
049F B4A5	791	JMP	DAT6	
04A1 BC0E	792 DAT5:	MOV	R4,#14	

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04A3 54B7    793      CALL     DELAY
04A5 B3       794  DATE:   RET
795  ;
796  ;
797  ;----- OUTPUT DATA TEST
798  ;
799  ;
800 OUTST:
04AE B84D    801      MOV      R0, #IDBUF
04AB F0       802      MOV      A, @R0
14A5 37       803      CPL     A
14AA CEB0    804      JZ      OUTS1
14AC 9472    805      CALL    DATOUT
14AE 84B8    806      JMP    OUTS3
14B0 B8ED    807 OUTS1:  MOV      R0, #IDQUE
14B2 B000    808      MOV      @R0, #0
14B4 BC12    809 OUTS2:  MOV      R4, #1B
14B6 54B7    810      CALL    DELAY
14B8 B3       811 OUTS3:  RET
812
813
814 ;***** GATE TEST ROUTINE
815 ; CALLED FROM FORE GROUND
816 ;*****6*****
817 ;
818 ;*****6*****
819
04B9 05       820 GTEST: IN      A, P1      ;TEST IF GATE SWITCH
04BA 37       821 CPL     A
04BE B6D4    822 JBS    GTEST1      ;CLOSED SET TO BYPASS
04BD BC01    823 MOV    R4, #01      ;DELAY 1 MSEC
04BF 54B7    824 CALL    DELAY
04C1 05       825 IN      A, P1      ;RE-TEST GATE SWITCH
04C2 37       826 CPL     A
04C3 B6D4    827 JBS    GTEST1      ;SET SYNC LINE HIGH
04C5 99BF    828 ANL    P1, #0BFH      ;ICK FOR DATA OUT
04C7 94AE    829 CALL    OUTST      ;TURN-OFF GATE LIGHT
04C9 B671    830 MOV    R0, #DSTAT
04CB F0       831 MOV    A, @R0
04CC 5304    832 ANL    A, #04H      ;UPDATE PANEL LIGHTS
04CE A2       833 MOV    @R0, A      ;SET DELAY FOR 54 MSEC
04CF B4B8    834 CALL    TEST1
04D1 BC3E    835 MOV    R4, #50
04D3 B3       836 RET
04D4 BC00    837 GTEST1: MOV    R4, #2
04D6 B673    838 MOV    R0, #FAILB      ;CHECK IF SONAR LIGHTS
04D8 F0       839 MOV    A, @R0      ;SHOULD BE LIT
04D9 CEDD    840 JZ     GTEST2
04DB BCC0    841 MOV    R4, #0C0H
04DD B671    842 GTEST2: MOV    R0, #DSTAT      ;TURN-ON GATE LIGHT
04DF F0       843 MOV    A, @R0
04E0 4320    844 ORL    A, #E0H
04E2 4C       845 ORL    A, R4
04E3 A0       846 MOV    @R0, A
04E4 B4B8    847 CALL    TEST1
04EE BC00    848 MOV    R4, #0
04E8 B3       849 RET      ;SET TO TURN ON LOOP
850
851
852  ;
853  ;----- BLANK DISPLAY AFTER 400 MSEC
854  ; AND TEST FOR WORKING SONARS
855  ;
856  ;
0500
857      ORG    500H
858 BLKDIS:
0500 54D2    859      CALL    STEST      ;TEST FOR WORKING SONAR
0502 B82E    860      MOV    R0, #DSBUF      ;CLEAR DISPLAY BUFFER
0504 BD05    861      MOV    R5, #05
0506 B000    862 LPBLK:  MOV    @R0, #0H
0508 10      863      INC    R0

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0509 ED0E	864	DJNZ	R5, LPBLK
050B F41C	865	BKDISE: CALL	DSWR _E
050D B3	866	RET	;OUTPUT TO DISPLAY
	867		
	868		
	869	;	
	870	;	DETECTION ROUTINE FOR COW PRESENTS
	871	;	S.U. PINS 20 19 TURN ON SIGNALS PORT 2, BITS 7 E
	872	;	PINS 13 12 ECHO SIGNALS PORT 1, BITS 1 0
	873	1	
	874	;	
	875		
	876		
050E B877	877	DETCT: MOV	R0, #DTIME
0510 10	878	INC	@R0
0511 F0	879	MOV	A, @R0
0512 CE1E	880	JZ	DETCT1
0514 A488	881	JMP	TEST1
	882	DETCT1:	
051E B0FE	883	MOV	@R0, #DCOUNT
0518 9A3F	884	ANL	P2, #3FH
051A BC01	885	MOV	R4, #1
051C 54B7	886	CALL	DELAY
051E BA40	887	ORL	P2, #040H
0520 BC05	888	MOV	R4, #5
0522 54B7	889	CALL	DELAY
0524 09	890	IN	A, P1
0525 323D	891	JB1	NOPRS1
	892		
0527 B878	893	MOV	R0, #ONDLY1
0529 10	894	INC	@R0
052A F0	895	MOV	A, @R0
052B 9651	896	JNZ	RSENE
			;CHECK FOR ON DELAY
52D B87A	897	MOV	R0, #OFLDY1
52F B0FE	898	MOV	@R0, #OFCNT
531 B871	899	MOV	R0, #DESTAT
533 F0	900	MOV	A, @R0
534 4380	901	ORL	A, #80H
536 A0	902	MOV	@R0, A
527 BC02	903	MOV	R4, #0E
539 54CA	904	CALL	SSTAT
538 A451	905	JMP	RSENE
	906		
	907	NOPRS1:	
	908		
153D B87A	909	MOV	R0, #OFLDY1
153F 10	910	INC	@R0
1540 F0	911	MOV	A, @R0
1541 9651	912	JNZ	RSENE
1543 B878	913	MOV	R0, #ONDLY1
1545 B0FE	914	MOV	@R0, #ONCNT
1547 B871	915	MOV	R0, #DSTAT
1549 F0	916	MOV	A, @R0
154A 537F	917	ANL	A, #7FH
154C A0	918	MOV	@R0, A
154D BCFD	919	MOV	R4, #0FDH
154F 54C2	920	CALL	RSTAT
	921		;RESET ENTRANCE STATUS
	922	RSENE:	
0551 BC01	923	MOV	R4, #1
0553 54B7	924	CALL	DELAY
0555 BA80	925	ORL	P2, #80H
0557 BC05	926	MOV	R4, #E
0559 54B7	927	CALL	DELAY
055B 09	928	IN	A, P1
055C 1274	929	JB0	NOPRS1
	930		
055E B879	931	MOV	R0, #ONDLY2
0560 10	932	INC	@R0
0561 F0	933	MOV	A, @R0
0562 9688	934	JNZ	TEST1
0564 B87B	935	MOV	R0, #OFLDY2

0566 B0FE	936	MOV	R0, #0FCNT
0568 B871	937	MOV	R0, #DSTAT
056A F0	938	MOV	A, @R0
056B 4340	939	ORL	A, #40H
056D A0	940	MOV	@R0, A
056E BC04	941	MOV	R4, #04H
0570 54CA	942	CALL	SSTAT
0572 A488	943	JMP	TEST1
	944		
	945 NOFRSE:		
0574 B87B	946	MOV	R0, #DFDLYE
0576 10	947	INC	@R0
0577 F0	948	MOV	A, @R0
0578 9688	949	JNZ	TEST1
057A B879	950	MOV	R0, #ONDLYE
057C B0FE	951	MOV	@R0, #ONCNT
057E B871	952	MOV	R0, #DSTAT
0580 F0	953	MOV	A, @R0
0581 53BF	954	ANL	A, #0BFH
0583 A0	955	MOV	@R0, A
0584 BCFB	956	MOV	R4, #0FBH
0586 54C2	957	CALL	RSTAT
	958		UPDATE STATE TABLE
	959 TEST1:		
0588 B871	960	MOV	R0, #DSTAT1
058A F0	961	MOV	A, @R0
058B B832	962	MOV	R0, #DSBUF+4
058D A0	963	MOV	@R0, A
058E 18	964	INC	R0
058F A0	965	MOV	@R0, A
0590 F41C	966	CALL	DSWR2
0592 83	967	RET	UPDATE PANEL LEDS
	968		
	969 IDTST:		
0593 B87D	970	MOV	R0, #IDLEC2
0595 10	971	INC	@R0
0596 F0	972	MOV	A, @R0
0597 96AA	973	JNZ	IDTS2
0599 B0D3	974	MOV	@R0, #CNT2
059B B87C	975	MOV	R0, #IDLECT
059D 10	976	INC	@R0
	R		; CHECKS IF COW IS LIT
059E F0	977	MOV	A, @R0
059F 96AA	978	JNZ	IDTS2
05A1 B0FD	979	MOV	@R0, #CNT1
05A3 B84E	980	MOV	R0, #NEWDAT
05A5 B099	981	MOV	@R0, #099H
05A7 18	982	INC	R0
05A8 B099	983	MOV	@R0, #099H
05AA 83	984	IDTS2:	RET
	985		
	986 ;		
	987 ;		
	988 ;-----		
	989 ;		INPUT DATA CONVERSION ROUTINE
	990 ;-----		
	991 ;		
0600	992	ORG	600H
	993		
	994 DATCON:		
0600 E837	995	MOV	R0, #INBUFH+2
0602 F0	996	MOV	A, @R0
0603 77	997	RR	A
0604 530F	998	ANL	A, #0FH
060E AE	999	MOV	R3, A
0607 18	1000	INC	R0
060E F0	1001	MOV	A, @R0
0609 E7	1002	RL	A
060A 53F0	1003	ANL	A, #0F0H
060C DB	1004	XRL	A, R3
060D A1	1005	MOV	@R1, A
060E 19	1006	INC	R1
060F F0	1007	MOV	A, @R0
0610 E7	1008	RL	A

0E11 530C
0E13 47
0E14 AB
0E15 18
0E16 F0
0E17 77
0E18 533F
0E1A DB
0E1B A1
0E1C 83
1009 ANL A, #0CH
1010 SWAP A
1011 MOV R3, A
1012 INC R0
1013 MOV A, @R0
1014 RR A
1015 ANL A, #3FH
1016 XRL A, R3
1017 MOV @R1, A
1018 RET
1019 ;
1020 ;

1021 PUSH-- STORES TRANSPONDERS FIFO
1022 ;
1023 ; R4-- TRANSPODER # MSB
1024 ; R3-- TRANSPODER # LSB
1025 ;
1026
1027 PUSH:
0E1D B86D
0E1F F0
0E20 034D
0E22 A9
0E23 FE
0E24 A1
0E25 19
0E26 FC
0E27 A1
0E28 10
0E29 10
0E2A F0
0E2B 03E0
0E2D E631
0E2F B000
0E31 83
1028 MOV R0, #IDQUE
1029 MOV A, @R0
1030 ADD A, #IDBUF
1031 MOV R1, A
1032 MOV A, R3 ;TRANS # LSB
1033 MOV @R1, A
1034 INC R1
1035 MOV A, R4 ;TRANS # MSB
1036 MOV @R1, A
1037 INC @R0
1038 INC @R0 ;NEXT AVAILABLE LULP
1039 MOV A, @R0
1040 ADD A, #-3E ;OVERFLOW
1041 JNC PUSH1
1042 MOV @R0, #0
1043 PUSH1: RET
1044
1045 ;
1046 ; STATE TABLE ROUTINE
1047 ;
1048
1049 STTBL:
0E32 B873
0E34 F0
0E35 966C
0E37 B87E
0E39 F0
0E3A AC
0E3B 03F9
0E3D C643
0E3F 07
0E40 07
0E41 9E52
0E43 B876
0E45 F0
0E46 CE52
0E48 B84E
0E4A B948
0E4C F0
0E4D A1
0E4E 18
0E4F 19
0E50 F0
0E51 A1
0E52 FC
0E53 E7
0E54 E7
0E55 E7
0E56 B974
0E58 61
1050 MOV R0, #FAILB
1051 MOV A, @R0
1052 JNZ STTBL1
1053 MOV R0, #PSTATE
1054 MOV A, @R0
1055 MOV R4, A
1056 ADD A, #-7
1057 JZ STTB0
1058 DEC A ;IF STATE 8 OR 9
1059 DEC A
1060 JNZ STTB1
1061 STTB0: MOV R0, #IDFLG
1062 MOV A, @R0
1063 JZ STTB1
1064 MOV R0, #NEWDAT
1065 MOV R1, #OLDDAT
1066 MOV A, @R0
1067 MOV @R1, A
1068 INC R0
1069 INC R1
1070 MOV A, @R0
1071 MOV @R1, A
1072 STTB1: MOV A, R4
1073 RL A
1074 RL A
1075 RL A ;PREVIOUS STATE + 6
1076 MOV R1, #PRESSST
1077 ADD A, @R1 ;NEW STATE LOCATION =
1078 ;(PREV STATE*8 + STATUS
1079 MOV R3, A
1080 MOV R3, A

0E5B B872	1081	MOV	R0, #FSTATE
0E5D 03A6	1082	ADD	A, #90
0E5F CEE6	1083	JZ	ST90
0E61 07	1084	DEC	A
0E62 CE71	1085	JZ	ST91
0E64 07	1086	DEC	A
0E65 CE79	1087	JZ	ST92
0E67 07	1088	DEC	A
0E68 CE7D	1089	JZ	ST93
0E6A FB	1090	MOV	A, R3
0E6B A0	1091	MOV	@R0, A
0E6C B3	1092	STTBL1:	RET ;STORE NEW STATUS
	1093		
	1094	ST90:	
0E6D B001	1095	MOV	@R0, #1 ;NEW STATE = 1
0E6F C481	1096	JMP	ACCID ;ACCEPT ID
	1097		
	1098	ST91:	
0E71 B002	1099	MOV	@R0, #2 ;NEW STATE = 2
0E73 B87E	1100	MOV	R0, #IDFLG
0E75 B000	1101	MOV	@R0, #0
0E77 C481	1102	JMP	ACCID ;ACCEPT ID
	1103		
	1104	ST92:	
0E79 B003	1105	MOV	@R0, #3 ;STATE = 3
0E7B C481	1106	JMP	ACCID
-	1107		
	1108	ST93:	
0E7D B001	1109	MOV	@R0, #1
0E7F C4AD	1110	JMP	NULCOW
	1111		
	1112	ACCID:	
0E81 B87E	1113	MOV	R0, #IDFLG
0E83 B000	1114	MOV	@R0, #0
	1115	ACPTID:	
0E85 B848	1116	MOV	R0, #OLDDAT
0E87 F0	1117	ACPTD1:	MOV A, @R0
0E88 AE	1118	MOV	R3, A ;TRANS # LSB
0E89 B000	1119	MOV	@R0, #0
0E8B 18	1120	INC	R0
0E8C F0	1121	MOV	A, @R0
0E8D AC	1122	MOV	R4, A ;TRANS # MSB
0E8E B000	1123	MOV	@R0, #0
0E90 D41D	1124	CALL	PUSH ;OUTPUT TRANSP NUMBER
0E92 B3	1125	RET	;TO PARLOR CONTROLLER
	1126		
	1127	ACPNEW:	
0E93 B841	1128	MOV	R0, #BCDFTR ;SENSING FAILURE
0E95 F0	1129	MOV	A, @R0 ;SO ACCEPT I.D.
	1130		
0E96 AE	1130	MOV	R3, A
0E97 18	1131	INC	R0
0E98 F0	1132	MOV	A, @R0
0E99 AC	1133	MOV	R4, A
0E9A D41D	1134	CALL	PUSH
0E9C B3	1135	RET	
	1136		
	1137	REMCOW:	
0E9D B848	1138	MOV	R0, #OLDDAT
0E9F B0AA	1139	MOV	@R0, #0AAH
0EA1 18	1140	INC	R0
0EA2 B0AA	1141	MOV	@R0, #0AAH
0EA4 B84E	1142	MOV	R0, #NEWDAT
0EA6 B000	1143	MOV	@R0, #0
0EA8 18	1144	INC	R0
0EA9 B000	1145	MOV	@R0, #0
0EAB C481	1146	JMP	ACCID
	1147		
	1148		
	1149	NULCOW:	
0EAD B876	1150	MOV	R0, #IDFLG
0EAF F0	1151	MOV	A, @R0
0EB0 96B9	1152	JNZ	NULCW1
0EB2 B848	1153	MOV	R0, #OLDDAT ;COW WITHOUT TRANSFONDER

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06B4 B000	1154	MOV	@R0, #0
06B5 18	1155	INC	R0
06B7 B000	1156	MOV	@R0, #0
06B9 C481	1157	NULCW1: JMP	ACCID
	1158		;SEND COW NUMBER &
	1159	ACPSEN:	;FOR BLANK DISPLAY
06BB B3	1160	RET	
	1161		
	1162	-----	
	1163	STATE TABLE	
	1164	AS DEFINED IN STATE FLOW-CHART	
	1165	-----	
	1166		
0300	1167	ORG	0300H
	1168		
0300 01	1169	DB	1
0301 01	1170	DB	1
0302 01	1171	DB	1
0303 01	1172	DB	1
0304 01	1173	DB	1
0305 01	1174	DB	1
0306 01	1175	DB	1
0307 01	1176	DB	1
	1177		
0308 01	1178	DB	1
0309 02	1179	DB	2
030A 03	1180	DB	3
030B 01	1181	DB	1
030C 04	1182	DB	4
030D 01	1183	DB	1
030E 01	1184	DB	1
030F 01	1185	DB	1
	1186		
0310 01	1187	DB	1
0311 02	1188	DB	2
0312 01	1189	DB	1
0313 05	1190	DB	5
0314 01	1191	DB	1
0315 06	1192	DB	6
0316 01	1193	DB	1
0317 01	1194	DB	1
	1195		
0318 01	1196	DB	1
0319 01	1197	DB	1
031A 03	1198	DB	3
031B 05	1199	DB	5
031C 01	1200	DB	1
031D 01	1201	DB	1
031E 07	1202	DB	7
031F 01	1203	DB	1
	1204		
0320 01	1205	DB	1
0321 01	1206	DB	1
0322 01	1207	DB	1
0323 01	1208	DB	1
0324 04	1209	DB	4
0325 06	1210	DB	6
0326 0C	1211	DB	12
0327 01	1212	DB	1
	1213		
0328 01	1214	DB	1
0329 02	1215	DB	2
032A 17	1216	DB	23
032B 05	1217	DB	5
032C 01	1218	DB	1
032D 01	1219	DB	1
032E 01	1220	DB	1
032F 08	1221	DB	8
	1222		
0330 01	1223	DB	1
			;PREV. STATE = 5

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0331 02	1224	DB	2	
0335 01	1225	DB	1	
0333 01	1226	DB	1	
0334 04	1227	DB	4	
0335 06	1228	DB	6	
0336 01	1229	DB	1	
0337 08	1230	DB	8	
	1231			
0338 01	1232	DB	1	;PREV. STATE = 7
0339 01	1233	DB	1	
033A 03	1234	DB	3	
033B 01	1235	DB	1	
033C 0F	1236	DB	15	
033D 01	1237	DB	1	
033E 07	1238	DB	7	
033F 08	1239	DB	8	
	1240			
0340 01	1241	DB	1	;PREV. STATE = 8
0341 01	1242	DB	1	
0342 01	1243	DB	1	
0343 05	1244	DB	5	
0344 01	1245	DB	1	
0345 06	1246	DB	6	
0346 09	1247	DB	9	
0347 08	1248	DB	8	
	1249			
0348 01	1250	DB	1	;PREV. STATE = 9
0349 01	1251	DB	1	
034A 5C	1252	DB	92	
034B 01	1253	DB	1	
034C 11	1254	DB	17	
034D 01	1255	DB	1	
034E 09	1256	DB	9	
034F 08	1257	DB	8	
	1258			
0350 01	1259	DB	1	;PREV. STATE = 10
0351 01	1260	DB	1	
0352 01	1261	DB	1	
0353 01	1262	DB	1	
0354 01	1263	DB	1	
0355 01	1264	DB	1	
0356 01	1265	DB	1	
0357 01	1266	DB	1	
	1267			
0358 01	1268	DB	1	;PREV. STATE = 11
0359 01	1269	DB	1	
035A 01	1270	DB	1	
035B 01	1271	DB	1	
035C 01	1272	DB	1	
035D 01	1273	DB	1	
035E 01	1274	DB	1	
035F 01	1275	DB	1	
	1276			
0360 01	1277	DB	1	;PREV. STATE = 12
0361 01	1278	DB	1	
0362 1E	1279	DB	30	
0363 01	1280	DB	1	
0364 04	1281	DB	4	
0365 01	1282	DB	1	
0366 0C	1283	DB	12	
0367 19	1284	DB	25	
	1285			
0368 01	1286	DB	1	;PREV. STATE = 13
0369 01	1287	DB	1	
036A 01	1288	DB	1	
036B 01	1289	DB	1	
036C 01	1290	DB	1	
036D 01	1291	DB	1	
036E 01	1292	DB	1	
036F 01	1293	DB	1	
	1294			

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LOC	OBJ	LINE	SOURCE	STATEMENT	PREV. STATE
0370	01	1295	DB	1	
0371	01	1296	DB	1	
0372	01	1297	DB	1	
0373	01	1298	DB	1	
0374	01	1299	DB	1	
0375	01	1300	DB	1	
0376	01	1301	DB	1	
0377	01	1302	DB	1	
		1303			
0378	SD	1304	DB	93	
0379	01	1305	DB	1	
037A	01	1306	DB	1	
037B	01	1307	DB	1	
037C	0F	1308	DB	15	
037D	0E	1309	DB	6	
037E	07	1310	DB	7	
037F	01	1311	DB	1	
		1312			
0380	01	1313	DB	1	
0381	01	1314	DE	1	
0382	01	1315	DE	1	
0383	01	1316	DE	1	
0384	01	1317	DB	1	
		1318			
0385	01	1319	DB	1	
0386	01	1320	DE	1	
0387	01	1321	DE	1	
		1322			
0388	5A	1323	DP	90	
0389	01	1324	DB	1	
038A	01	1325	DE	1	
038B	01	1326	DB	1	
038C	11	1327	DB	17	
038D	0E	1328	DB	6	
038E	09	1329	DB	9	
038F	01	1330	DB	1	
		1331			
0390	01	1332	DE	1	
0391	01	1333	DE	1	
0392	01	1334	DB	1	
0393	01	1335	DB	1	
0394	01	1336	DE	1	
0395	01	1337	DB	1	
0396	01	1338	DB	1	
0397	01	1339			
		1340			
0398	01	1341	DB	1	
0399	01	1342	DB	1	
039A	01	1343	DB	1	
039B	01	1344	DB	1	
039C	01	1345	DB	1	
039D	01	1346	DB	1	
039E	01	1347	DB	1	
		1348			
03A0	01	1349	DB	1	
03A1	01	1350	DB	1	
03A2	01	1351	DE	1	
03A3	01	1352	DB	1	
03A4	01	1353	DB	1	
03A5	01	1354	DB	1	
03A6	01	1355	DB	1	
03A7	01	1356	DB	1	
		1357			
03A8	01	1358	DB	1	
03A9	01	1359	DB	1	
03AA	01	1360	DE	1	
03AB	01	1361	DE	1	
03AC	01	1362	DB	1	
03AD	01	1363	DE	1	
03AE	01	1364	DB	1	

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LOC	OBJ	LINE	SOURCE STATEMENT	
03AF	01	1365	DB	1
		1366		
03B0	01	1367	DB	1
03B1	01	1368	DB	1
03B2	01	1369	DB	1
03B3	01	1370	DB	1
03B4	01	1371	DB	1
03B5	01	1372	DB	1
03B6	01	1373	DB	1
03B7	01	1374	DB	1
		1375		
03B8	01	1376	DB	1
03B9	01	1377	DB	1
03BA	17	1378	DB	23
03BB	05	1379	DB	5
03BC	01	1380	DB	1
03BD	01	1381	DB	1
03BE	05	1382	DB	9
03BF	01	1383	DB	1
		1384		
03C0	01	1385	DB	1
03C1	01	1386	DB	1
03C2	01	1387	DB	1
03C3	01	1388	DB	1
03C4	01	1389	DB	1
03E5	01	1390	DB	1
03C6	01	1391	DB	1
03C7	01	1392	DB	1
		1393		
03CB	01	1394	DB	1
03C9	01	1395	DB	1
03CA	01	1396	DB	1
03CB	1A	1397	DB	26
03CC	01	1398	DB	1
03CD	0E	1399	DB	E
03CE	0C	1400	DB	12
03CF	19	1401	DB	25
		1402		
03D0	01	1403	DB	1
03D1	01	1404	DB	1
03D2	03	1405	DB	3
03D3	1A	1406	DB	26
03D4	01	1407	DB	1
03D5	01	1408	DB	1
03D6	01	1409	DB	1
03D7	19	1410	DB	25
		1411		

LOC	OBJ	LINE	SOURCE STATEMENT	
03D8	01	1412	DB	1
03D9	01	1413	DB	1
03DA	01	1414	DB	1
03DB	01	1415	DB	1
03DC	01	1416	DB	1
03DD	01	1417	DB	1
03DE	01	1418	DB	1
03DF	01	1419	DB	1
		1420		
03E0	01	1421	DB	1
03E1	01	1422	DB	1
03EE	01	1423	DB	1
03E3	01	1424	DB	1
03E4	01	1425	DB	1
03E5	01	1426	DB	1
03EE	01	1427	DB	1
03E7	01	1428	DB	1
		1429		
03EB	01	1430	DB	1
03E9	01	1431	DB	1
03EA	01	1432	DB	1
03EB	01	1433	DB	1
03EC	01	1434	DB	1

03ED 01	143E	DE	1
03EE 01	143F	DE	1
03EF 01	143G	DE	1
	143H		,
03F0 01	1439	DE	1
03F1 01	1440	DE	1
03F2 1E	1441	DE	30
03F3 03	1442	DB	3
03F4 01	1443	DB	1
03F5 01	1444	DB	1
03F6 0C	1445	DB	1E
03F7 01	1446	DB	1
	1447		,
03F8 01	1448	DB	1
03F9 01	1449	DB	1
03FA 01	1450	DB	1
03FB 01	1451	DB	1
03FC 01	1452	DB	1
03FD 01	1453	DB	1
03FE 01	1454	DB	1
03FF 01	1455	DB	1
	1456		,
	1457		,
	1458		,
	1459	;	DISPLAY--DISPLAY MANAGER ROUTINE
	1460	;	,
	1461	;	,
	1462	;	,

0700

1463 ORG 0700H

1464

1465 DISPLAY:

0700 0A07	1466	ORL	P2, #DSEL
0702 BAE	1467	MOV	R2, #0E
0704 B9E	1468	MOV	R1, #DSBUF
0706 F0	1469	DSPL1:	MOV A, @R2
0707 530F	1470	ANL	A, #0FH
0709 03E0	1471	ADD	A, #0E0H;
070B A3	1472	MOVF	A, @A
070C A1	1473	MOV	@R1, A
070D 19	1474	INC	R1
070E F0	1475	MOV	A, @R0
070F 53F0	1476	ANL	A, #0F0H
0711 47	1477	SWAP	A
0712 03E0	1478	ADD	A, #0E0H
0714 A3	1479	MOVF	A, @A
0715 A1	1480	MOV	@R1, A
0716 18	1481	INC	R0
0717 19	1482	INC	R1
0718 EAEE	1483	DJNZ	R2, DSPL1
071A 546E	1484	CALL	BNKTST
071C B62E	1485	DSWR2:	MOV R0, #DSBUF
071E F0	1486	MOV	A, @R0
071F BAE	1487	MOV	R2, #05
0721 9AFD	1488	ANL	P2, #KEYCA
0723 E392	1489	MOV	A, #DSCMD
0725 90	1490	MOVX	@R0, A
0726 9AFC	1491	ANL	P2, #KEYDA
0728 F0	1492	DSWR1:	MOV A, @R0
0729 90	1493	MOVX	@R0, A
072A 18	1494	INC	R0
072B EAEE	1495	DJNZ	R2, DSWR1
072D 0A07	1496	ORL	P2, #DSEL
072F 83	1497	RET	
	1498		,
	1499	;	,
	1500	;	XMIT--TRANSMIT ROUTINE
	1501	;	,
	1502	XMIT:	
0730 C8	1503	DEC	R0
0731 1E	1504	TRAN1:	INC R0
0732 0A07	1505	ORL	P2, #DSEL

LOC	OBJ	LINE	SOURCE STATEMENT	
0734	9AFC	1506	ANL P2, #UARTCA	
073E	81	1507	TRAN2: MOVX A, @R1	;READ STATUS
0737	37	1508	CPL A	
0738	1E3E	1509	JBO TRAN	
073A	2311	1510	MOV A, #11H	;OUTPUT READY?
073C	91	1511	MOVX @R1, A	;DISABLE RECEIVER
073D	81	1512	TRAN4: MOVX A, @R1	
073E	37	1513	CPL A	
073F	123D	1514	JBO TRAN4	
0741	9AFA	1515	ANL P2, #UARTDA	
0743	F0	1516	MOV A, @R0	
0744	91	1517	MOVX @R1, A	;WRITE BYTE TO UART
0745	81	1518	MOVX A, @R1	;RD DATA (= ZERO RXREADY)
074E	EA31	1519	DJNZ R2, TRAN1	;NEXT BYTE
0748	8A01	1520	ORL P2, #01	;WAIT FOR TX RDY
074A	81	1521	TRAN3: MOVX A, @R1	;WAIT FOR TX EMPTY
074B	37	1522	CPL A	
074C	524A	1523	JBO TRAN3	
074E	2315	1524	MOV A, #15H	
0750	91	1525	MOVX @R1, A	;ENABLE RECEIVER
0751	8A07	1526	ORL P2, #DSEL	
0753	83	1527	RET	
		1528	;	
		1529	REPEAT:	
0754	B822	1530	MOV R0, #OUTBUF	
0756	B40E	1531	MOV R2, #0EH	
0758	F430	1532	CALL XMIT	
075A	B934	1533	MOV R1, #INPTR	
075C	B102	1534	MOV @R1, #00H	
075E	83	1535	RET	
		1536	;	
		1537	;	
		1538	----- RECEPTION ACKNOWLEDGE ROUTINE -----	
		1539	-----	
		1540	-----	
		1541	ACKN:	
075F	B9E2	1542	MOV R1, #IDADD	
07E1	F1	1543	MOV A, @R1	;LOAD ADDRESS
07E2	A0	1544	MOV @R2, A	
07E3	BA02	1545	MOV R2, #0E	;TRANS ACKN
07E5	E430	1546	JMP XMIT	
		1547	-----	
		1548	-----	
		1549	----- DISPLAY TABLE -----	
		1550	-----	
		1551	-----	
07E0		1552	ORG 07E0H	;START OF TABLE
07E0	3F	1553	DB 3FH	; "0"
07E1	0E	1554	DB 0EH	; "1"
07E2	5E	1555	DB 5EH	; "2"
07E3	4F	1556	DB 4FH	; "3"
07E4	6E	1557	DB EEH	; "4"
07E5	ED	1558	DB 6DH	; "5"
07E6	7C	1559	DB 7CH	; "6"
07E7	07	1560	DB 07H	; "7"
07E8	7F	1561	DB 7FH	; "8"
07E9	EF	1562	DB 6FH	; "9"
07EA	00	1563	DB 00H	; "BLANK"
07EB	40	1564	DB 40H	; "-"
07EC	61	1565	DB E1H	; "C"
07ED	79	1566	DB 79H	; "E"
07EE	50	1567	DB 50H	; "r"
07EF	71	1568	DB 71H	; "F"
		1569	;	
		1570	END	

SER SYMBOLS

CCID 0681	ACKN 075F	ACPNEW 0693	ACPSEN 06BB	ACPTD1 0687
OPTID 0685	ADDSET 00F1	BCDPTR 0041	BCNT 0021	BCOUNT FFD3

IN1	0285	BINBCD	027D	BINPTR	0043
XTST2	027C	BLCNT	00EE	BLKDIS	0500
AL_	00E5	CLKTIM	003B	CLOSED	0000
NT2	FFD3	COUNT	00A5	COUNT1	00FA
ATE	0485	DAT2A	0489	DAT3	0485
ATE	04A5	DATCON	0600	DATLOW	003F
EC00	04E4	DECO1	0402	DECO2	044A
EC05	045D	DECODE	0400	DELAY	02B7
FLAG	0070	DSBUF	002E	DSCMD	0090
SPLAY	0700	DSTAT	0071	DSWR1	0728
VALID	004B	EXTINT	00FD	FAILB	0073
OREQA	00AE	FORE1	008A	FORE2	008C
OREE	00AE	GDLY	FFC4	GLIGHT	0020
TEST2	04DD	HFBIT	004C	IDADD	0020
DCNTL	004A	IDFLG	007E	IDLEC2	007D
DTIME	FFB3	IDTS2	059A	IDTST	0E93
NIT79	0034	INPTR	0034	INTS1	01B3
EYBLK	00D0	KEYCA	00FD	KEYCMD	0002
PBLK	050E	NEWDAT	004E	NOPRS1	053D
ULCW1	0EE9	OFCNT	FFF4	OFDLY1	007A
LDBUF	0028	OLDDAT	0048	ON	00FF
NDLY2	0079	OPEN	00FF	OUTBUF	0022
UTS3	04B8	OUTST	04A8	PARITY	0045
DP2	0E85	PREAME	003E	PRESET	0074
USH1	0E31	PWRLIT	0040	RAMT	007F
DHB1	02EA	RDHBIT	025D	RDWD1	021D
DWD4	0247	RDWORD	0200	REGB0	0000
EFEAT	0754	RIGHTU	00F9	RSENE	0551
T90	0EED	ST91	0E71	ST92	0E75
IART	0009	STATUS	006F	STEST	02D3
TRT1	001E	STTB0	0643	STTB1	0E52
EST1	0528	TIM2A	0126	TIM2E	0130
IMEE	017A	TIMEBA	0191	TIMEC	0193
IMEL	0E42	TIMINI	011C	TIMINE	0124
IMIN7	01AD	TIMINE	01AD	TIMINT	0102
RANE	073E	TRAN3	074A	TRAN4	073D
JRNON	045E	UARTCA	00FB	UARTCM	0015
RTMD	009A	XFER	0467	XFER1	046D

BKDIS2	050B	--	BKTST1	0272
BNKTST	026E	--	BUSFRE	026D
CLRDAT	001C	--	CNT1	FFF4
COUNT2	0078	--	DAT1	047E
DAT4	0499	--	DAT5	04A1
DATOUT	0472	--	DCOUN1	FFF4
DEC02B	044C	--	DEC04	045B
DETCT1	0516	--	DETECT	050E
DSEL	0007	--	DSPL1	070E
DSWR2	071C	--	DTIME	0077
FORE	008A	--	FORE0	0094
FORE3	00CE	--	FOREA	00AC
GTEST	04B9	--	GTEST1	04D4
IDBUF	004D	--	IDCLR	005E
IDLECT	007C	--	IDQUE	006D
INBUF	0035	--	INIT51	0020
INTS2	01C8	--	INST	01AF
KEYDA	00FC	--	KEYPSC	0020
NOPRS2	0574	--	NULCOW	06AD
OFDLY2	007B	--	OFF	0000
ONCNT	FFF4	--	ONDLY1	0078
OUTS1	04B0	--	OUTSE	04B4
POF	029B	--	POF1	02A1
PSTATE	0072	--	PUSH	0E1D
RDBIT	024A	--	RDBIT1	0255
RDWD2	0227	--	RDWD3	023C
REGB1	001B	--	REMCOW	0E9D
RSTAT	02C2	--	SSTAT	0ECA
ST93	0E7D	--	STACK	0008
STEST1	02ED	--	STEST2	02F1
ETTB1	0E32	--	STTB1	0EEC
TIM2C	0128	--	TIMEA	0175
TIMED	019D	--	TIMEH	00F5
TIMIN3	0145	--	TIMIN4	015B
TNOFF	0462	--	TRAN1	0731
TRCNT	FFF4	--	TRCNTR	0075
UARTDA	00FA	--	UARTL	003C
XMIT	0730	--		

ASSEMBLY COMPLETE, NO ERRORS

We claim:

1. An electronic identification system for identifying an object moving through a portal structure comprising:
 - at least one generating means for generating a multi-directional electromagnetic field in a plurality of different angular relations to the direction of movement of the object through the portal structure;
 - at least one first receiving means for attachment to the object for receiving and storing energy from the electromagnetic field;
 - at least one transmission means for attachment to the object for transmitting identifying data after the at least one first receiving means has received energy from the electromagnetic field;
 - at least one second receiving means for receiving the identifying data from the object; and
 - a flexible curtain secured to the portal structure, wherein the at least one generating means and the at least one second receiving means comprise an antenna loop secured to the flexible curtain.
2. The system of claim 1 comprising separate detector

45 means for detecting the presence of the object within the portal structure.

3. The system of claim 2 wherein the separate detector means comprises an ultra-sonic transducer at the entrance to the portal structure and an ultra-sonic transducer at the exit to the portal structure whereby the separate detector means can determine the direction of movement of the object through the portal structure.

50 4. The system of claim 2 and including a microprocessor for controlling the at least one generating means, the at least one first receiving means, the at least one transmission means, the at least one second receiving means and the separate detector means.

55 5. The system of claim 1 wherein the curtain has pocket flaps and comprising stiffener plates located in said flaps for strengthening the curtain and for maintaining the proper angular orientation of the antenna loop.

60 6. The system of claim 1 further for identifying a plurality of objects, wherein individual objects move through one of a plurality of portal structures, the system comprising:

65 a plurality of generating means;
a plurality of first receiving means, each for attach-

- ment to individual objects;
 a plurality of transmission means, each for attachment to individual objects;
 a plurality of second receiving means; and
 a plurality of flexible curtains, each of the flexible curtains being secured to individual portal structures, and each of the generating means and the second receiving means comprising an antenna loop secured to individual flexible curtains.
7. The system of claim 6 also comprising microprocessor control means for controlling the plurality of generating means, the plurality of first receiving means and the plurality of second receiving means, wherein the microprocessor control means determines whether individual generating means and individual second receiving means are activated at a given point in time.
8. An electronic identification system for identifying an animal moving through a portal structure comprising:
- a parallel resonant circuit connected to the portal structure including a double antenna loop for alter-

- nately generating a multi-directional electromagnetic field in a plurality of different angular relations to the direction of movement of the object through the portal structure and receiving identifying data concerning the animal;
- 5 a flexible curtain attached to the portal structure, said loop being located in said curtain;
- 10 a transponder adapted to be worn by the animal for receiving energy from the electromagnetic field and, when the electromagnetic field is removed, for transmitting the identifying data to the first parallel resonant circuit; and
- 15 separate detector means for detecting the presence and direction of movement of the animal as the animal moves through the portal structure.
9. The system of claim 8 wherein the curtain has pocket flaps and comprising stiffener plates located in said flaps for strengthening the curtain.
- 20 10. The system of claim 8 wherein the separate detector means comprises at least one ultra-sonic transducer.
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